

AVIATION WEEK

A MCGRAW-HILL
PUBLICATION

January 28, 1957 50 cents

Sabena Tripling
Helicopter
Traffic Volume



Cessna T-37As

Report on Soviet Space Flight Planning

engineers agree

Not on how to mix a Martini —
nor necessarily on how to build
a missile platform —
but every day,
throughout the industry,
Engineers agree
on Wiggins Connectors.

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specification:
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dependability

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North American P-50B Super Sabre

hytrol

When the need of failure is the least —
when maximum dependability is the
most important part of the equation
— the answer is HYTROL.

Super Sabre fighters come in two lots
to be before reaching to get a "fail"
to the braking action. Obviously, the
landing gear is critical for what is
the result.

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- No right turnouts due to slacking.
- 25% more free wheel.
- Safety that pays off in dollars.
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dollars.
- Maximum protection against
overheating, jamming, or late
take-off reactions.
- Maximum protection against ice
and snow in place.

HYTROL — the accepted Anti-
Skid Braking System is standard
equipment on the B-47,
B-52, A-10, F-4, F-5, F-105,
F-106, C-119, QF-90 and has
been proved on more than 50
different types of aircraft.



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The complete collection of

CRANE

Hytrol and
HY-1014 Ball
Bearing are
standard
equipment on
this P-100



Another famous plane

PROVEN IN SERVICE

1932

On the day the *Sigsbee* was launched, the famous *Sigsbee* was the first aircraft to fly over the world's longest bridge.

Today, the famous *Sigsbee* is a family-owned company of the good old days. But even in 1932, a quarter of a century after Rockbestos won and could have used a proven service reputation.

Today, Rockbestos can look back on 20 years of developing and manufacturing quality wire and cable, and a long history of close association with the aviation industry. Rockbestos has continuously produced high temperature wire which meets the exacting demands of modern airplanes . . . both military and commercial.

Rockbestos will continue to develop wires to meet the aircraft industry's needs. Find out just how Rockbestos can help solve your high temperature wiring problems. Write, wire or phone for complete specifications and application information.

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AVIATION CALENDAR

(Continued from page 3)

- Feb. 25—Helicopter Firm and Rotor Working Group, International Air Transport Assn., New York, N. Y.
- Feb. 24-25—North Atlantic Treaty Association Conference & Short Course on Fuel Control, including aircraft and equipment display, Memorial Stadium, College, Agricultural & Mechanical College of Texas College Station. Fly-in participation via air transport field.
- Feb. 26-28—Western Joint Computer Conference, sponsored by ORF, MIT and ACM, Fleet Street, Los Angeles, Calif.
- Mar. 4-5—7th Annual Air Safety Forum, Air Line Pilot Assn., Fleet Street, Chicago, Ill.
- Mar. 7-9—National Conference on Aviation Electronics, Hotel Mayflower, Washington, D. C.
- Mar. 11-14—1957 Atomic Exposition including Nuclear Engineering & Science Congress, 4th Atomic Energy in Industry Conference and 4th Eng. Laboratories & Equipment Conference, Convention Hall, Philadelphia, Pa.
- Mar. 14-15—Aircraft Production Meeting (classified), sponsored by IAS, Hotel Carter Cleveland Ohio.
- Mar. 18-21—National Convention Institute of Aeronautics, New York, Cleveland and Hotel Waldorf Astoria New York.
- Mar. 18-21—First Military, Automatic Navigation, New York Trade Show Building, 501 Fifth Ave., New York. See daily note: Richard Edwards Associates, 545 Fifth Ave., Pittsburgh 17, Pa.
- Mar. 27-29—Electronic Conference on Radiation Effects on Materials sponsored by Office of Naval Research and Chas. L. Martin, Co., John Hopkins University, Baltimore, Md.
- Apr. 23—National Aeronautic Meeting, Aeronautic Products Forum and Aircraft Engineering Display, sponsored by Society of Automotive Engineers (SAE) Convention, New York.
- Apr. 25—Spring Meeting, American Rocket Society, Aviation Park, Hotel, Washington, D. C.
- May 4-10—1957 Annual National Forum, Aeronautic Helicopter Society, Houston, Texas, Houston, Texas, D. C.
- May 24-26—1957 First Air Show Society of North American Convention, Inland Empire, Pa.
- June 1-3—Joint American National Aviation Trade Show, Minneapolis, Minn. (N. F.) Airport.
- June 21-25—20th Annual Meeting Aviation (Aeronautics & Astronautics), The Sheraton, California Springs, Calif.
- July 10-14—1957 Lockheed International Aeronautic Conference, the National Air Forum (naval aircraft and the Navy's Ship Air Base, Conway Civil Aviation, Birmingham, England).
- Sept. 16-20—1957 International Aeronautical Congress, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Farnborough and London, England.
- Sept. 24-27—Flying Display, Society of British Aircraft Constructors, Farnborough, England.
- Sept. 9-11—1957 Annual Ground Meeting, International Air Transport Assn., Madrid.

RYAN BUILDS BETTER



NOW! AUTOMATIC NAVIGATION FOR GLOBAL JET FLIGHT

An advanced system of aerial navigation, with the speed and precision demanded by high speed jet flight, has been developed by Ryan under sponsorship of the Navy's Bureau of Aeronautics. Using continuous-wave radar, in which Ryan is a recognized leader, the Ryan AN/APN-47 navigator will enable fast-flying military planes and future commercial jetliners to travel in any part of the world's surface with rare accuracy and speed.

Instantaneous in operation, the Ryan navigator gives the pilot his position (latitude and longi-

tude), ground speed, ground mileage, drift angle and ground track in continuous, available form. No computations are necessary. The equipment is compact and self-contained. No ground facilities are employed—no wind information or aerological data are needed.

This significant contribution to jet navigation is typical of the work which Ryan and the military services are accomplishing in other fields of electronics research such as supersonic missile guidance for the Air Force and helicopter hovering devices for the Navy.

Electronic engineers will find a challenging future with outstanding opportunities at Ryan.

BUILDING AVIATION PROGRESS SINCE 1922
Aircraft • Power Plants • Avionics
Ryan Aeronautical Company, San Diego, Calif.





SIMMONDS PACITRON

FLIES ON THE CARAVELLE

With an initial order of twelve Caravelle jet transports, AIR FRANCE guarantees its policy of operating the most advanced equipment... and this policy calls for the specification of Simmonds lightweight Pacitron Fuel Gauge Systems. Through past experience and uniformity of flight miles, AIR FRANCE has proven that Pacitron provides the ultimate in reliable fuel measurement and management.

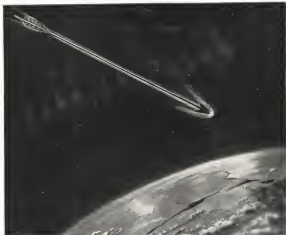
First choice with more than 40 airlines, the Pacitron system makes possible additional important functions of fuel management and control, including automatic control of gravity control of fuel weight distribution, low level switching through thermostat level switches and automatic load limit control in accordance with the flight plan.

Simmonds pioneered the first electronic fuel gauge installation over ten years ago. Today's aviation world continues to recognize Simmonds' leadership as "first in electronic fuel gauging."

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When the tip sublimes!

Away up where it's cold, black and lonely at 300,000 ft., the thermal attack on a missile or "morpher" isn't very successful. The air molecules at that height are barely scolding neighbors, rather than crowded together in a fluid mass. But, escape and re-entry into the earth's dense envelope of atmosphere generates thermal attacks of frightening ferocity. Nose and leading-edge temperatures may rise to 3000°F.

Even titanium won't stand such temperatures for more than a few minutes. For all those areas requiring long-term service life up to 3000°F, however, titanium's light weight, great strength and corrosion resistance offer

outstanding design advantages.

Production quantities of very high strength heat-treated steel, in close pipe and flange tolerances, are being engineered into advanced aircraft and missiles. For non-military applications, all types of steel products are obtainable at considerably lower price levels.

T.M.C.A. is again adding to its production facilities to properly service an ever-expanding market. T.M.C.A. engineering service and technical literature are readily available to all those industries challenged by weight, strength and corrosion problems.

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Modification

Modification suggests alteration and manufacturing flexibility. Aircraft modification and flexibility are synonymous at Hayes. This applies both to facilities and personnel, due to the versatility of Hayes engineers.

The huge Hayes plant is divided into ten separate and independent bays — each embracing 116,000 square feet of an assembly line and working area. These

are supported by conveniently located machine shops, wiring assembly lines and mammoth presses for structural shaping.

Add to these physical advantages the versatility of Hayes specialized engineering groups, and it becomes obvious why Hayes is able to meet tight delivery schedules simultaneously in the modification of many different types of aircraft.

TO ENGINEERS AND SCIENTISTS

The rapid growth and expansion of Hayes creates a continuing need for mechanical, electrical, aircraft design engineers and graduate engineering students, for which new opportunities open up almost daily. Hayes now has over 8,000 employees and is a competitive employer for modification and maintenance work. Write Personnel Department, P. O. Box 2207.

ENGINEERS • DESIGNERS • MANUFACTURERS



LORD ENGINE MOUNTINGS PROVIDE

more comfort and safety for

Since pre World War II days, major production aircraft at Lockheed have been equipped with Lord Dyanfoal Suspension Systems. These produce effective "center-of-gravity" support for piston and turboprop engines, contributing its smoothness and comfort for passengers and crew. While furnishing powerful engine thrust and torque, Lord Dyanfoal Mountings isolate engine disturbances, reduce noise, minimize wear to the airframe and improve the overall safety of the craft.

For the finest in aircraft engine mountings, look to Lord—the leader in Engineering and Precision Control and Inspection products. For information, call your nearest Lord Field Engineer or the Home Office, Erie, Pennsylvania.



L

ELECTRA (1934):

One of the first all-metal passenger planes. Howard Hughes flew one around the world in 1931.



O

HUDSON (1936):

First American-made plane to fight in World War II. First plane to capture a submarine.



C

LODESTAR (1939):

Firstest pre-war commercial transport. Several during war as troop, cargo and liner carrier.



K

VENTURA (1942):

Versatile all-around bomber of World War II. Backbone of Navy's Pacific air striking force.



H

CONSTELLATION (1943):

First used as high-speed Air Force transport. Now used by airlines all over the world.



E

NEPTUNE (1945):

Navy's first land-based patrol plane carries bombs, torpedoes, mines. Also operates from carriers.



E

SUPER CONSTELLATION (1952):

Ultimate passenger plane. Also used as high-altitude reconnaissance plane for Air Force and Navy.



D

HERCULES (1953):

Aircraft freighter. Turboprop powered for high speeds, can carry 20-ton payload.

Lord Dyanfoal Suspension



Lord bonded rubber engine mountings are standard on most modern aircraft. Their rugged dependability ensures superior vibration isolation throughout a long service life.

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and producers
of bonded
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HEAT that could buckle an aircraft's skin



The engine compartment of McDonnell Aircraft Company's F-101A Mustang is protected with JM structural insulation. This new high-temperature resistant insulation was recently ordered for use in the production of the Air Force.

... safely controlled by
new Johns-Manville structural insulation

New Problems. The engine compartment of today's jet aircraft is a "hot spot" both literally and figuratively. Not only are engine temperatures rising higher, power speeds have produced higher air flow velocities and complex pressure problems. These new conditions call for a radical departure in insulation design.

New Answers. Many designers have successfully combined these engine compartment heat problems with the

help of Johns-Manville. In the JM laboratories new insulating methods have been developed which are adaptable to practically every type of aircraft. Among these is a totally new concept in structural insulation designed especially for engine compartments in the new Century series as well as the latest naval aircraft.

Matchless Experience. In the field of structural insulation, no other company can match the experience of

Johns-Manville insulation scientists. From the very beginning of the jet age they have been working closely with all the major engine and aerospace manufacturers. Today they are busy developing new materials in new shapes and sizes for the insulating problems of tomorrow.

Why not put this experience to work for you? Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Post Credit, Ontario.



Johns-Manville

PRODUCTS FOR THE
AVIATION INDUSTRY

TO CONVERT OR ABSORB THERMAL EFFECTS AT LOW COST SYLPHON[®] BELLOWS AND ASSEMBLIES



Whether design problems involve thermal, pressure or mechanical effects, Fulton Sylphon can help you use the simple, foolproof bellows principle to best advantage. For one thing, an unmatched engineering service assures you of the right bellows or bellows assembly. Specialized skills and facilities also enable

Fulton Sylphon to produce complete bellows assemblies at lower cost than you could yourself. And only from Fulton Sylphon can you get the extra know-how that comes from 52 years of experience with every conceivable bellows application!

Send for Bellows Bulletin
AA-100



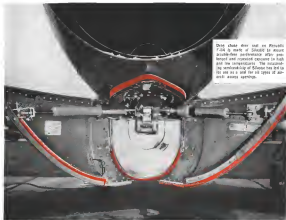
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BELLOWS
HEADQUARTERS,
U.S.A.



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CONTROLS COMPANY

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Typical Properties of Silastic for Seals

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• Elongation, %	150 to 300
• Tear strength, lb/in	90 to 75
• Compression set, %, @ 300 F	25 to 30
• Hardness range, Durometer	20 to 60
• Weather, ozone and corona resistance	Excellent

If you consider ALL the properties of a silicone rubber, you'll specify SILASTIC

First in silicones

DOW CORNING
SILICONES

DOW CORNING CORPORATION • MIDLAND, MICHIGAN



One manufacturer used flexible shafts to replace 35 parts in a hydraulic Power System—cut costs by 90%. Four flexible shafts replaced a 35-part remote-control system . . . simplified design . . . made assembly easier . . . eliminated alignment problems . . . improved performance!

This is only one of hundreds of remote control and power drive problems these quality

flexible shafts are solving in every industry. Can 8½ White flexible shafts help improve your product? Perhaps make it lighter in weight . . . cut production costs . . . eliminate unnecessary parts!

If you'd like to know more about flexible shafts, the advice of our engineers costs you nothing. Just write to

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Western Office: 1030 West 15th Street, Los Angeles 5, Calif.



Shouldn't you be sure to solve most every flexible shaft? Write for Bulletin 3544



Plexiglas

...the standard transparent plastic for small planes, too ...

The use of Plexiglas acrylic plastic in aircraft is by no means confined to cockpit enclosures and windows on the country's lighters, bombers, jet fighters and commercial transports. Manufacturers of planes for business and pleasure flying, like the makers of the Cessna 310 shown above, also use Plexiglas—to give their customers unimpaired visibility and good service characteristics with the efficiency and good service characteristics that are built into today's small aircraft.

Plexiglas is the standard material for transparent enclosures because it has the required clarity, strength, light weight, flexibility and weather-resistance. Throughout the aviation industry, manufacturers count on the twenty-year experience of Rohm & Haas Company, as the supplier of Plexiglas, for help in solving special aircraft-planning problems. They also can draw on constant research at Rohm & Haas to meet the quality of transparent plastic on higher levels, to meet the requirements of planes of the future.



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For more information, see 11-1, Pat. Off. and in other
publications in the Western Hemisphere.



Message from Melbourne

A recent short wave broadcast from Melbourne, Australia, received in Syracuse, N. Y. (over 10,000 air miles) with no perceptible flutter or fading, is further proof that General Electric's new radio technique, Synchronous Amplitude Modulation, is the solution to the problems of long range radio operations. Its concept and operation are uniquely simple. SAM is compatible with all present forms of radio equipment, its operation.

training... yet it preserves complex wave forms even while heading the Doppler effect. Its superposed carrier, double sideband transmission and synchronous reception promise significant savings in weight and cost. Of paramount importance is SAM's resistance to jamming and interference. Here again, is a vivid example of GE's available contribution to progress in furthering new uses for electronics.

For the very latest information on SAM... write Section A.



Aviation Electronics Products Include:

WEAPONS CONTROL RADAR • SEARCH RADAR • INDICATOR AND DISPLAY • COUNTERMEASURES • NAVIGATION
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Report Flays British Air Industry 26

House of Commons Select Committee assails aircraft industry for waste and failure in blistering report.

BOAC Urges Uniform North Atlantic Jet Guidance 39

British Overseas Airways Corp. warns airlines to adopt uniform track guidance system for North Atlantic jets.

Soviets Show Avid Interest in Space Travel 60

Soviet scientists propose moon exploration with rockets and television cameras, along with other possibilities.

AERIAL ENGINEERING 26

British Test System 26

Heavy Bombers Revisited 26

Correll Radio Facility 26

Super Priority for M-48s 26

Military Locomotive Revisited 26

Report on Soviet Aeronautics 26

Black Eagle, General Smith 26

New Helms Program 26

42 C-124s to be used by Army 26

Traffic and Revenue Data 26

Airline Income and Expenses 26

Shipment 26

Conquest Transport 26

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B.F. Goodrich



BREAKS ICE FASTER—Close-up view: aluminum cone and quick-acting carbon cylinder make B. F. Goodrich's automatic De-Ice valve an efficient, dependable system of ice protection.



GRITS FIGHTER, A LONGER REACH—Steel Shell, Remitts learn aircraft engine system to force incoming wing cracks to lighter plane, prevent a violent crash without weight loss for



LAIRDS HIS OWN—DEG wheel and brake assemblies give maximum strength, low weight, safe stops. New DEG high capacity disc brake closely specified for proper contours.



PROPELLER PROTECTION—Electric De-Ice for propellers to clear ice on blades, cuffs and tips, give added protection against swirling effects of ice, sand and dust.



HEATED WHEEL—DEG electrically heated wheel and brake. Plastic shoe shows how it provides heat for oil valve on maximum flow of oil to prevent ice formation.



TAKE OFF WEIGHT—DEG Tailcone. Thin, light weight, close profile, bigger capacity. Dimpled steel mesh sheet, inner center, gives new loadings before warping.

B. F. Goodrich Aviation Products improve performance, cut over-all weight, reduce maintenance

FROM THE VERY BEGINNING of the aviation industry, B. F. Goodrich engineers have designed equipment with an eye to dependable performance, lower weight and less maintenance.

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vent pins or high air pressure and new charcoal De-Ice for smaller interior tubes that prevent the formation of ice film.

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EDITORIAL

USAF Faces Budget Squeeze

Last year we called the original Fiscal 1957 airpower budget submitted by the President to Congress a fraud because it would not support the level of airpower which its advocates claimed, and they knew full well that it would not. Events during the past 12 months have proved conclusively just how much of a deliberate deception this budget proposal really was.

Less than three months after it was submitted, the administration abandoned the pretense that this budget was adequate and asked Congress for an additional \$300 million for aircraft and missiles. By mid-year, Congress had added approximately another \$1 billion.

Even then, the administration and its Pentagon branchmen claimed that this additional money was not really necessary and could not be wisely used. Now we hear from the Pentagon's fiscal expert, Assistant Secretary Wilfred McNell, that \$708 million of this extra money has already been obligated for the long range ballistic missile program, and other portions of the extra money have been obligated to accelerate aircraft production. This indicates clearly that the congressional majority that boosted USAF funds for Fiscal 1957 was more accurate in its appraisal of the real requirements for financing adequate airpower than were the President's staff and military advisers who drafted the original plan.

Proclamation vs. Fact

For three years, the administration publicly proclaimed that its airpower budget economies would not impair USAF's progress in heading toward the goal of 137 even bat wings. As late as last year, the administration spokesmen in both Congress and the Pentagon stoutly declared there had been no change in this goal and insisted that fiscal policies were sufficient to support it.

Naturally, everybody who has followed the progress of airpower budgets in the past can't know that was simply not true.

But not until January 1957, less than six months from the date USAF was supposed to achieve its 137 wing strength, did the administration publicly admit that that goal had been abandoned and announce a programmatic cutback to 128 wings. But even this step in the direction of candor was characterized by some sleight of hand maneuvering that are more characteristic of a corrupt wheel and deal operator than responsible federal officials.

Two significant changes have been introduced by the Defense Department in the statistical which for convenience and public understanding has been used to measure airpower.

• First, USAF Wings that have already been in existence have been transferred from the support status to the combat wing program. These include at least three C-123 small transport wings and possibly a pooled missile wing.

• Second, a "third dimensional approach" has been introduced into the budget discussion for the first time

which adds carryover funds appropriated but not obligated last year into the Fiscal 1958 program to give it an air of candor not justified by the facts.

In addition, the administration is still not telling the whole truth about its wing cutback program. Although a genuine cutback to 120 wings is clearly indicated by the Fiscal 1958 budget after the 128-wing shell game sleight of hand is eliminated, the administration's fiscal policy already has programmed a cut to 112 USAF wings by 1960. Thus, the administration is already clearly committed to a cutback in USAF strength for the remaining years of President Eisenhower's second term that is far in excess of what it has yet publicly admitted.

What Is Real Issue?

We hold no particular brief for the 137 wing level as a magic number or a guarantee for all military airpower problems, and we would not argue with the claim that 112 wings equipped with a wide variety of atomic weapons, supersonic all weather fighters, guided missiles and B-52 bombers represent more genuine combat strength than 137 wings equipped with subsonic aircraft and conventional weapons.

But this is not really the point at issue. The real issue is whether the modern airpower programmed for the 112 wing program will be significantly superior to what the Soviet air force and its satellites will have in the air by the same date.

We also firmly believe that the American people, whose welfare and future is at stake, have a right to know the facts as to what is being done for the defense of their country. We believe they have a right to know the whole truth on the defense they are paying for and depending on—not just fragments of the truth that some government officials feel are "safe" to tell them or fear seems that, while true in themselves, can be strung together to produce a totally misleading picture. In announcing its Fiscal 1958 defense budget, the administration has finally begun to tell the truth about its planned military airpower program, but it still has a long way to go before it gives the American public the whole truth about this vital subject.

Gradual Decline

The sad fact is that the Fiscal 1958 budget, like its predecessor of the last three years, will produce a gradual decline in the ratio of American airpower strength to the atomic-strength wings which combinations of potential enemies may have during the next three to five years.

USAF is facing the inevitable consequences of a steady budget squeeze that will reduce its future strength faster than replacement of equipment and weapons will increase it. This is the most sound which the congressional debate on the Fiscal 1958 defense budget will offer.

—Robert Hutz

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its
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WHO'S WHERE

In the Front Office

Dr. James A. Marsh, vice president, Systems Laboratories Corp., Barham, Ohio, Ohio; **Mr. Richard H. De Lano**, director of company's systems integration division; **Carl E. Schmitt**, member vice president, Crane Packing Co., Morton Grove, Ill.; **Yoram B. Yarden**, vice president, R. H. Stead, vice president manufacturing.

E. U. Dufosse, vice president operations, Jerry Gyroscopic Co., Jackson Spire Road, Cary, Conn. 06113, N.Y.

Dr. Oliver G. Henshaw, vice president and manager Electronics and Avionics Division, Emerson Electric Manufacturing Co., St. Louis, Mo.

Dr. Douglas H. Ewing, vice president Research and Engineering, USAF Company Inc., Annapolis, Md. 21403, N.Y. Also **Harold W. Lawrence**, assistant director of research, RCA Laboratories.

Sam Dufosse, vice president general and sales group, Combustion Turbine and Turbine Co., Albany, Ohio. Mr. Dufosse succeeds Joseph E. Marsh, retired.

Capt. F. D. Frohman (USN, ret.), vice president production, and **D. G. Bates**, vice president program management, Reaction Motors Inc., Dayton, N.J.

Samuel J. Condon, vice president government projects (Washington, D.C.), Aero Machine Division, Minneapolis-Husquelt Republic Co., Minneapolis, Minn.

Stanley Gorman, vice president, National Airlines Inc., New York, N.Y. Also **Richard A. Fitzpatrick**, vice president (Washington, D.C.).

Henry Singleton, assistant vice president Aerochemical Division, Aerochemicals Division, Co., Anaheim, Calif.

Lawrence H. Cooper, manager Los Angeles office, American North Asia Corp., Hollywood, N.Y. Mr. Cooper is former president and director of Hall-Kott Inc.

Honors and Elections

Mr. Commodore F. R. Burke, a director of the Board of Directors of the Institute of the Aeronautical Sciences in recognition of contributions to aviation. **George P. Judd**, director of field control engineering at the Jerry Gyroscopic Co. has been selected by the Institute of the Aeronautical Sciences to receive the *Lamar E. Sperry Award* "for significant contribution to the advancement of personnel in aviation flight and its related field." The following have been elected to three year terms on the Institute of the Aeronautical Sciences Council: **William B. Bergman**, executive vice president; **Clarence L. Sherry**, Co. Vice President; **Charles E. Chubb**, president, Robinson Instrument Corp.; **Jack K. Fisher**, vice president, General Electric Co.; **Henry J. E. Hoff**, Director, Lincoln Aeronautical Laboratory, NACA; and **Edward C. Wells**, vice president engineering, Boeing Aircraft Co.; **Raymond C. Schell**, vice president engineering, General Division, General Dynamics Corp. has been elected to serve the remaining two years of the term of **Moody I. Peck**, now DAS president.

(Continued on page 117)

INDUSTRY OBSERVER

Watch for Defense Department addition to begin containing travel expenses of engineers submitted by defense contractors in allowable rates on government contracts. Pentagon thinking is being toward cutting down the percentage of engineering cost in allowable rates, particularly where it goes for travel expenses for moving an engineer from one contractor to another as a result of contracting campaigns.

Rolls-Royce RA 29 Area turboprop engine now scheduled for use in the de Havilland Comet IV transport has 1,000 lb. more thrust than the earlier RA 25 conventional engine. Added thrust is due primarily to the addition of an extra "core stage" to the compressor. RA 29 has 11,000 lb. thrust with 16 compressor stages and an engine weight of 3,145 lb. as compared with 10,000 lb. thrust, 15 compressor stages and an engine weight of 2,900 lb. for the RA 25.

Watch for the USAF Navy plant cognizance now to exist over General's San Diego plants. Plans are now under Navy cognizance, but USAF currently accounts for 99% of General's San Diego orders because Navy recently completed over the high cost of secure, clearance operations for explicit being based at these plants for the Atlas (CBM) program, and USAF refused to let out all cognizance responsibilities. Last now over cognizance was during the Korean war when the Air Force made a gain at Pratt & Whitney's Connecticut plants because of a major shift in production and development business from Navy to USAF. Now, however, hold out F&W plant cognizance.

Hughes Tool Co.'s Aircraft Division has received three Army research contracts for the development of a flying crane using parashutists as its power source. The program's X-17 may be discontinued and its components used as a test program to establish the advantages of the pressure jet as a propulsion system. X-17 was flown at 40,000 ft. gross and although only a research vehicle—did a pay load of 5,000 lb.

Four American engine manufacturers have negotiated with General's Overland Engines Ltd. regarding licensing agreements for manufacture of General's F511 turboprop engine. Turbine will be installed in a B-7 test bed and is rated at 20,000 lb. thrust and 30,000 lb. with afterburner.

Western Hemisphere rights to the French-developed low-frequency Radio Web navigation-aids control system have been obtained by Strick Engineering, Inc., of Hartford, N.J. The system is considered to assist in a navigation in Vietnam and Soviet says it also could provide extensive collision avoidance protection.

Boeing Aircraft Corp., of Los Angeles has received an initial order for 140 B-52G aluminum alloy external fuel tanks for the Boeing B-52. Tanks will incorporate selected polymers making heretofore used construction. One B-52 will carry two of the units.

Boeing Aircraft Corp. is expected to win Navy's utility helicopter competition with the company's HU-1A, a tandem powered by the Wright R-1300 engine. Already about four months earlier, Boeing's "Arrow" as a replacement of its decision is expected this week.

Fairchild Aircraft hopes to sell its C-123 aircraft transported in the Venezuela as force. The aircraft already has been demonstrated to top Air Force officers, in Venezuela and interest is reported high because of the aircraft's performance on short fields common to that part of the world.

Schlesinger being program for Army's Robinson aircraft calls for funds to be launched on alternate Tuesday night at 9:00 p.m. General begins at Air Force Missile Test Center, Cocoa, Fla. after a night's lapse in holidays.

Second test round in the Vanguard program, the 14th Marine-built Viking rocket, is expected to be launched within the next two weeks.



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MAKING THE FUTURE IN MECHANICAL EQUIPMENT

Washington Roundup

Budget Support From Twining

Look for Gen. Nathan F. Twining, Air Force Chief of Staff, to defend the reduction of USAF's goal from 137 to 128 wings in proposed in the Fiscal 1956 budget (AW Feb. 25, p. 26). The General knows that 128 wings is not the maximum under USAF's present programming. The 1960 goal, 112 wings.

Gen. Twining, however, will tell the whole truth if congressmen ask him how much the slash will damage America's aerospace capabilities. If the Democrats cut into or vote out of his measure, they are welcome to do so, but Gen. Twining cannot put himself in the position of helping to provide a fight.

Key to this situation is the fact that Gen. Twining is slated to succeed Adm. Arthur Radford as chairman of the Joint Chiefs of Staff this year and, as such, will be top military adviser to the Executive Administration.

Hearings on the budget will begin this week at executive session of the House Appropriations Subcommittee on the Armed Services headed by Rep. George Milson (D-Tex.). Lead off witnesses will be Adm. Radford and Defense Secretary Charles E. Wilson, followed by the secretaries and chiefs of staff of the armed services. Gen. Twining expects to be called late this week or early next week. By March, the subcommittee expects to draft into three groups—Army, Navy and Air Force—for more detailed consideration of the military programs.

New Look of Profits

House Armed Services Investigating Subcommittee headed by Rep. Edward Hebert (D-La.) will look into the procurement practices and profits of aircraft engine and parts manufacturers. It will also examine last year's investigation of defense manufacturers. John Courtney, former Navy Department and Justice Department attorney, remains as subcommittee counsel.

In another move, the Senate Proprietors Subcommittee headed by Sen. Lyndon Johnson (D-Tex.) is reported to approve and allow within the next future report dealing with arms and space, granted more than 50th special attention to procurement ethics and policies in the employment of military officers in private firms. The subcommittee staff, headed by Daniel McChesney who formerly served with Army counterintelligence and the Federal Bureau of Investigation, already has completed its first work.

The House Military Appropriations Subcommittee's staff has also completed its report on the Military Air Transport Service and military aircraft procurement. But no decision has been made on public release. Last year, the subcommittee and the Air Force should handle an air transport business in such a way as to avoid keeping the unscheduled and other aircraft in a reasonably sound financial and operating position.

Outlook Good for Burke

The outlook is bright for congressional approval of funds to begin construction of a new airport at Bader, Va., an alternate to Washington National Airport—this, despite opposition of the Maryland delegation and some within the Senate Appropriations Subcommittee. The subcommittee is expected to submit a request for \$55 million appropriations sometime this week.

Senate Appropriations members opposed to the proj-

ect—Sen. Spencer Holland (D-Ill.) and Sen. Margaret Chase Smith (R-Me.)—offer a new study aimed toward reaching a different solution to the problem of an traffic congestion in the Washington area. As an interim measure, they are studying that same scheduled airport expansion and all private plane operations at Washington National be shifted to Baltimore's Friendship Airport. The shift of Military Air Transport Service operations from Washington National to Andrews AFB will be completed by July 1.

Hearings on Ross

The House Government Operations Military Subcommittee headed by Rep. Chet Holifield (D-Calif.) is scheduled to open hearings shortly on the award of over \$5 million in defense contracts to a data drive by the wife and brother-in-law of Robert Trapp Ross, Assistant Secretary of Defense for Legislative and Public Affairs (AW Feb. 22, p. 25). Ross has taken a leave of absence from his post.

Stock Hearings

Public Senate hearings into the flood of purchases of Northwest Airlines stock after the crash was avoided a New York Market crash, probably will begin in mid-February. Northeast stock trading jumped from 400 shares on Aug. 2, when the Civil Aeronautics Board voted the new rule on interstate routes, to over 20,000 shares on Aug. 3, although the decision was not made public until Aug. 10. The staff of the Senate Permanent Joint Committee on Investigations headed by Sen. John McClellan (D-Ark.) has enough information for a start.

Partisan or Bipartisan CAB?

While Congressional Democrats are becoming in strength, concerned over the administration's policy of appointing its supporters to Democratic posts on the Civil Aeronautics Board and other quasi-judicial agencies (AW Jan. 18, p. 18), many Democrats are arguing in the opposite direction—that all regulatory agency posts should be filled by bipartisan Republicans.

Republican Rep. J. Arthur Younger of California has proposed legislation which would create a new Department of Transportation and Communications to take over the functions of the CAB and other regulatory agencies.

"Our government will function much better if the work performed by these independent bodies is supervised by and made responsible to, the cabinet and the President, who, after all, bears the responsibility for the total existence, administration of, and operation," Younger declared. "I know of no corporate setup which permits groups within the corporation to operate and function independently of the board of directors. . . ."

On the other hand, Democratic Sen. Mike Monroney, of Oklahoma, voiced skepticism over the appointment of Louis Brandeis, a Florida Democrat who voted for Eisenhower in 1952 and 1956, to the Democratic CAB post vacated by Joseph Rogers.

"Although bipartisanship is required by law, many, even political agencies are now being directed solely by Republican members. This development threatens the theory of bipartisanship in the interlocking and interlocking of their operations." —Washington Staff

57

RETMA Pilot Study Analyzes Defense Spending for Avionics

Washington—An estimate of Defense Department spending for avionics and military electronics, based on an analysis by the Radio Electronic Television Manufacturers Association, appears to have substantiated the average rate of avionic spending for piloted aircraft, especially for as much as 60%.

The RETMA study has been broadly received by industry representatives as a valuable first attempt to provide immediate, available data on how much of the Defense Department budget goes for electronics. The figure is particularly difficult to assess for the avionics field where most of the expenditures are included in the overall figures for aircraft and missiles.

RETMA's analysis indicates that in Fiscal 1956 the Defense Department spent \$935 million for aircraft avionics equipment. This represents only 13% of the \$7.146 billion spent for aircraft, a figure which many observers believe is closer to 20-25%, perhaps even higher if avionics controls and instrumentation are included. The world plane the aircraft avionics expenditures in the neighborhood of \$2 billion for Fiscal 1955.

RETMA's estimate of Fiscal 1956 system expenditures for missiles as \$433 million, which represents about 15% of the \$3.161 million total spent for missiles. Qualified observers be-

lieve this figure may be slightly on the high side, with the avionic content of missiles running closer to 40-50%.

RETMA's figure of \$770 million for electronics and communications is based on the corresponding category in Defense Department budget figures. This includes many expenditures as devoted for avionic use, such as MAGE air defense computers and communications nets and air defense radar networks.

The figures released by RETMA for Fiscal 1956 Defense Department expenditures, as follows:

- Aircraft, \$935
- Guided missiles, \$630
- Electronics and communications, \$770
- Research and development, \$265
- Ships and harbor craft, \$80
- Coast defense vehicles, \$8.5
- Support vehicles, \$5.5
- Miscellaneous, \$47.5
- Total, \$2,773

British Plan Tests Of Skylark Rockets

London—The firing of the first Skylark models will begin soon at the Woomera range in Australia. British Aerospace Co. announced.

The company said the Skylark, powered by a Bristol-built Rocin rocket

New HF Developments

Two new developments will add fuel to the argument debate in the pros and cons of single channel compatible single channel and synchronous detection techniques for future military use at the Automated Radio has announced. One is a tech report, developed by Gresham Laboratories, Bedford, N. H., which may eliminate the common Doppler shift problem for synchronous single channel when used in high speed aircraft. The other is a simple adapter, developed by General Electric, which can convert existing HF receivers to operate with synchronous detection, providing much required intelligibility.

motor, is expected to reach an initial height of at least 70 mi. Later models are designed to reach an altitude of 125 mi.

Three of the Rocin motor is given as 31,500 lb. for approximately 30 sec. It is 18 ft long.

The research model, which is scheduled to fly three or four times, is 25 ft long and 17 1/2 inches in diameter. After year long tests, the British Royal Air Force's Security expects to single special equipment for use in Australia at the beginning of the International Geophysical Year in July.

The will include radio altimeter equipment for tests to discover temperatures and winds at altitudes between 20 and

60 mi. Radar tracking of "windward" target ships will be used to determine winds between 20 and 50 mi. up from sea to be measured by a pitot-static probe at the rear.

A second launching, now to be constructed at the Great Western Range at Aberystwyth, Wales. After initial tests at Woomera, part of the research program will go to Aberystwyth.

The rockets are launched from an 80 ft tower weighing 30 tons.

Cornell to Build Hypersonic Facility

Bethlehem, N. Y.—A facility in which aircraft and missile models can be tested to an inflow of 10,000 mph and at temperatures of 9,000 degrees F for periods of 15 sec or longer will be built by Cornell Aeronautical Laboratory Inc.

Preliminary design work is under way. Sponsor of the \$2 million contract is the Air Research and Development Command's Air Force Office of Scientific Research.

The relatively long test time plus the fact that air will be used—rather than hydrogen or helium—means the facility should make a major contribution to hypersonic research since actual flight conditions can be simulated much more closely.

Although some impulse tunnels are used at the duration of their high speed, high-temperature flow is associated with multistage.

Heart of the facility will be a "wave reflector"—a unique arrangement of tubes capable of producing a continuous flow of air at high speeds and temperatures.

The apparatus was conceived and developed by Cornell. A pilot model, developed under a previous Office of Scientific Research contract, is now operating here.

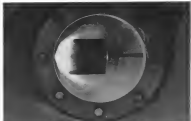
Convair Awarded F-106A Contract

San Diego, Calif.—Convair Division of General Dynamics Corp. has been awarded a \$70,200,000 USAF contract for an undelivered number of F-106A delta wing, all-weather jet interceptors and supporting equipment.

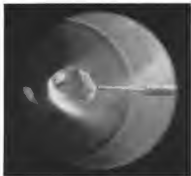
This second contract follows the initial \$140,000,000 contract Convair received from Air Materiel Command last summer.

The F-106A was first flown Dec. 26, 1955 and now is undergoing flight testing at Air Force Flight Test Center, Edwards AFB.

The F-106A will be produced at Convair's plant here.



BLUNT nose typical of hypersonic missile shapes gives automatically an 80,000 mph. Most of the model is in test at Cornell Aeronautical Laboratory shock tunnel.



NEW FEATURES suit 9,000°F. approaching the initial temperature of the air, are needed in shock tunnel at Cornell. Model here is simulated surface and not the actual situation of a test specimen.

West Germany Orders Pembroke Aircraft

London—The West German government has a \$5.6 million contract with British Aircraft Corp. Ltd. for two-engined Pembroke aircraft, for use in training and various other missions.

Deliveries of the eight passenger Pembroke aircraft, are to begin within a few months.

Already in use by other NATO countries and by Sweden, Finland and Southern Rhodesia, the aircraft can be utilized for passenger transport, casualty evacuation, supply drops, photo survey, air gun training and various other missions.



New Radioplane Drones for Navy

First three of the new rocket-powered target drone the XQ-40R-1—formerly known as RQ-78 (VW Oct. 22 p. 38)—have been delivered to the Naval Air Station, Fort Meigs, Calif. Drone developed and produced by Radioplane Co. of Van Nuys, Calif. is the Mark III class at \$6,000 ft. It has been designed as a training target for air force members and rocket weapons. It will be launched from the wings of a fighter plane. Except for the rocket engine section, which makes the rocket motor, the drone features plastic makeup. The rocket motor exhausts through openings on the top of the wing trailing edge. Drone can accommodate rocket tracking and scoring equipment. About 70 have been ordered by the Navy.



ONE OF SAC'S During B-52s rolls to a stop at March AFB, with main and flap deflecting the landing roll, after its record breaking, globe-girdling circuit of 24,325 mi. in 45 hr. 19 min.

B-52 World Mission Keyed to Mid-East

By Irving Stone

March AFB, Calif.—Commenting that no target in the world is beyond USAF capabilities for fast dispatching airplanes, those Boeing B-52s of the Strategic Air Command headed down here after flying a record-setting breaking globe-girdling circuit of 24,325 mi. in 45 hr. 19 min.

Average speed was 546 mph; top speed hit was between 600-650 mph. Plans flew at staggered levels so that if bad weather were encountered there would be no danger of collision. Flight was generally between 15,000 and 20,000 ft. Cabin pressurization was 15,000 to 20,000 ft. at 70,000 ft.

Crew did not wear pressure suits, but did change clothing according to terrain as water flows over so they would be ready for conditions in any place of emergency landings.

Gen Curtis LeMay, SAC command, and Maj Gen Archie Galt, Jr., who led the flight, both labeled the mission as "routine," although it came at a time which seemed to lay again, closely with the troubled situation in the Mid-East.

Training Mission

All of the 27 crew members of the three planes were given the Distinguished Flying Cross by LeMay in a ceremony shortly after landing. He said the flight was a good event to decorate some of "our people" for long hours and weekends adding that he wished he could decorate all of them.

LeMay emphasized that the flight



OPERATION Power Flight began at 3 p.m. Jan. 26, from March AFB where the three B-52s are based with the 9th Bomb Wing. Flight time would have been out 5 to 6 hr. of KC-135 jet tankers had been available for refueling. Plans, whose range exceeds 6,000 mi., flew to 230,100 mph for refueling with KC-97s.

was a training mission "as different than dozens of others." It was, apparent, he added, that technology was moving very fast, and that "we cannot rest on laurels or over what we did yesterday." He revealed that it had not been his final decision to order this mission, but refused to say where it was. Galt, commander of SAC's 13th AF, said, "We could not have been directed by LeMay to make the flight two or three weeks before."

The globe-girdling B-52s were unaccompanied. LeMay declared and some of the planes developed engine trouble. He said that originally five of the B-52s had taken off from Castle AFB, Calif., "with one plane leading in England, in planned and one leading in Labrador—confirmed." He did not elaborate, except to say, "We were supposed to fly three planes around the world and we did." The B-52 that aborted at Labrador returned to Castle AFB, Calif., the next day.

The scheduled combat mission took off at 3 p.m., Jan. 26th, from Castle AFB, where the B-52s are based with the 9th Bomb Wing, and after flying the around the world circuit, the three jet bombers touched down at March AFB, Jan. 31, at about one-minute intervals beginning 10:19 a.m. Two of the planes had been scheduled to land at Galt, one at March, but weather conditions caused all three to touch down together at March—approximately 30 min. after the first actually projected for the flight.

Galt explained that "some pretty bad weather" had been encountered, adding that the plane is a good reason why it should fly in the future. The worst of the weather consisted of thunderstorms over the Indian Ocean.

On its first leg, the world-circling flight set across the United States to Newfoundland, jumped the Atlantic to French Morocco, proceeded to the base near Saudi Arabia. Starting the coast of India and Ceylon, the B-52s circled in with control over near Ceylon and the Malay Peninsula. Off

the peninsula, a scheduled hour's drop was made and the flight continued to the Philippines, Guam, then home to March.

Refueling Limitations

The planes were refueled at night as well as during daylight hours, but LeMay would not reveal the number of refueling, nor the planes which were not been made with the Boeing jet-powered KC-97 tankers.

Planes slowed to 230-240 mph for refueling by KC-97s. Flight time of 45 hr. 19 min. would have been cut by 5 to 6 hr. if KC-135 jet tankers had been available for refueling. Each plane carried drop tanks for refueling but those tanks were not jet-powered.

Most of flight was on autopilot for about 37 to 50% of flight. Several crew of 10 per plane were throughout by addition of relief pilot, relief navigator, and crew chief.

Refueling in the 45 hr. 19 min. flight time. LeMay pointed out that SAC crews had flown the last B-52 jet tanker last flight, Jan. 26th, in the longest jet flight on record, made by a SAC B-47 which started back and forth

between England and French Morocco for 47 hr. 15 min.

The round the world flight of the three B-52s was made in less than half the time it took to fly the previous record 3-38 Superfortresses Lady II, which flew around the world non-stop at 94,000 ft. for 23,452 mi. in Feb. 1946.

On the day, Lady II, carried General Galt plus a top navigator, Wing Standardization Chief of the 9th Bomb Wing.

Aircraft commander was Lt. Col. James H. Morris, who had flown in the 3-38 Lady II. Pilot was Capt. Robert E. Campbell, with a total of 6,000 hours, including 3,000 on jet. Campbell has over 150 flying hours in B-52, high for SAC.

Flight was planned around communications with SAC during entire flight, stated Col. Morris. Weather forecasts were good. The rain and they did not take advantage of jet stream in route as "we didn't feel it necessary." "Problems," or "hitting still," was biggest factor. One hour's time was added for refueling, which usually occurred after 15 hours of flying.

Trident 2 Beats World Speed Mark

Four-Quest America's lightweight intercepting Trident 2, has easily passed the official world speed record in a test program dropped vertically to reach top speed of March 1.

Powered by SR-71 liquid propellant rockets in the tail and two wingtip Viper jet engines (AW Jan. 7, p. 13), Trident reportedly flew 1,243 mph (March 1, 1954) in test flight at probable altitude of 40,000 ft. Official speed record set last March by F-4 Phantom II set record speed of 1,112 mph. More recently, Canadian T-38 reportedly set an unofficial world record of 1,270 mph (March 1, 1954).

In the same test Trident set a new French altitude record of 95,000 ft. The world record is 65,000 ft. achieved by an English Electric Canberra.

The F-101H Tiger (AW Dec. 24, p. 26) matched an altitude of more than 72,000 ft. during its unofficial record run at USAF Flight Test Center, Edwards AFB, Calif.

Current Trident tests are being run out at Utah, French air force test center near Muroc. Actually, neither company nor French Air Ministry is making about being for official records.

That is, that to do so would require an effort which they are not equipped to carry out.

Trident's engine mounted on wingtip of first 10 Trident 2s are Douglas-built Armstrong Siddeley Viper at 2,500 lb thrust each. Next 10 will have Turbofan. General engines rated at 2,400 lb.



TRIDENT 2 which passed official world speed record is powered by two rocket engines in tail and intercepts mounted on wingtips. Wing tips are only 23 in., 5 in. less than that of previous, Trident 1. Plane is Quest-built.

Omnibus Aviation Bill Is Introduced

Washington—Omnibus civil aviation legislation, bringing current criteria under economic regulation by the Civil Aeronautics Board, has been reintroduced in Congress this session by Sen. John Stennis (R., Miss.), ranking member of the Senate Commerce Committee.

Indians, the administration and a majority in Congress have opposed any comprehensive rewrite of the 1938 CAA Act. Other bills introduced this session would:

- **Facilitate the transfer of officers** between the three military services. The measure, requested by the Department of Defense, was introduced by Rep. Carl Albert (D., Cal.), chairman of the House Armed Services Committee. Under it, an officer could be transferred to another service without both his consent and the consent of the secretaries of the two services involved.

- **Accelerate protection** from extrajurisdictional prosecution for the Association of Travel Agents, by an amendment to the 1938 CAA Act. Hearings last year before the House Anti-Monopoly Sub-Committee developed testimony that it is impossible for such agents to cater the 50th because scheduled airlines will not deal with them until they first obtain a license from the association. The measure was proposed by Rep. John Albert (D., Calif.).

- **Authorize appropriation** for the activities of the Civil Air Patrol. The bill was introduced by Rep. Gene Harris (D., Ark.), chairman of the House Commerce Committee.

- **Direct CAB** to obtain an amendment to the Warsaw Convention limiting the liability on international air travel. Under the convention, the amount which international passengers can collect for damages is substantially less than that which domestic passengers can collect. Introduced by Rep. Albert Bosch (R., N. Y.).

- **Permit the disposal** of industrial facilities through government auctions and government-financed plant expansion. Introduced by Rep. Milton George (R., Kan.).

U.S., Canadian Army Order DHC-4 Caribou

De Havilland Aircraft of Canada has been ordered for six DHC-4 Caribou twin-engine STOL utility transport aircraft from the U.S. Army and two for possible jet airplanes, its most requirements for the Canadian Army.

U.S. Army, which was awarded a contract for 5,000 B-1 first set by Defense Secretary Wilson for Army

fixed-wing aircraft (AW 104, p. 31) chooses the airplane as a cargo aircraft. Canadian Army requirement specifies the airplane must be a STOL, short take-off and landing, capable of carrying 30 fully-equipped troops.

Canadian Army took pains in wording of contract not to specify the aircraft would be operated by the army. The Canadian Army does have some Cessna 441s, but Royal Canadian Air Force has traditionally provided transport aircraft.

Caribou will carry a 23 1-ton payload at 10,000 ft, which would meet the Canadian Army requirement for capacity. It is expected to have a landing and take-off run of approximately 500 ft and be capable of operating out of a 1,000 ft strip.



Air Force First Jet Trainers

New training concepts will be embodied by the U.S. Air Force using three Cessna T-37A trainer jet aircraft recently delivered by the company's Pompano Beach plant. Four of the airplanes were delivered to Flying Training Air Force where 20 pilots will begin flying them at Gooding AFB, Tex., May 11. Initial group will have had 40 hr in piston-engine Beech T-34A trainers, a second group will have had 20 hr on the Beech and a third will be starting their training with no previous base. Each group will get 120 hr on its new T-37A. The 40th T-37A was sent to Eglin AFB, Fla. for speed school evaluation. These first fully operational jet trainers embody all modernization including revised cockpit layout and strengthened wing center section. Cessna will accelerate T-37A production to 17 planes monthly by mid-June; current contracts exceed 545 1 million.

Port & Vlahos, engines will power the first aircraft but eventual use of a turbo-prop engine is being studied. The airplane, which is now in mockup stage, has a tricycle undercarriage and tail landing to facilitate quick loading at truck bed height. Provision is made for quick entry to penetrate the extra cargo load.

Canadian Army considers the airplane as a point to point troop transport. Tests of parachuting mobile strike force troops have not been entirely satisfactory to the Canadian Army for use in cold climate operations.

Civil version of Caribou, which has been described previously as a troop-carrying Otter, would be able to carry 24 tons payload out of a 1,000 ft grass strip at Hamilton and



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CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION

GUIDED MISSILE RESEARCH AND DEVELOPMENT

A major guided missile research and development program has several significant characteristics that are of particular interest to the scientist and engineer.

First, it requires concurrent development work in a number of different technical areas such as guidance and control, aerodynamics, structures, propulsion and warhead. Each of these large areas in turn contains a wide variety of specialized technical activities. As an example, digital computer programs for the guidance and control area involve logical design, circuit design, programming, data conversion and handling, computer and system reliability, target weapon design, and environmental and mechanical design.

A second characteristic is frequently the requirement for significant state-of-the-art advances in several of the technical areas. For instance, the aerodynamic airframe needed for a new missile may necessitate not only novel theoretical calculations, but also the design and performance of new kinds of experiments.

A third characteristic of missile development work is that such close interrelationships exist among the various technical areas that the entire program must be viewed as a single, indivisible unit. For example, when it comes to the guidance portion of the system can affect directly what must be done in the propulsion and airframe portions of the system, and vice versa.

These characteristics make it clear that such work must be organized around strong teams of scientists and engineers. Further, for such teams to realize their full potential, they must be headed by competent scientists and engineers to provide the proper technical management. And finally, all aspects of the organization and its procedures must be tailored carefully to maximize the effectiveness of the technical people.

Principles such as those have guided The Ramo-Wooldridge Corporation, now in carrying out its responsibility for overall systems engineering and technical direction for the Air Force Intercontinental and Intermediate Range Ballistic Missiles. These major programs are characterized by their importance in the national defense and by the high degree of challenge they offer to the qualified engineer and scientist.

Growing need for
scientists and engineers
in these fields of
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SPECTATORS watch Sikorsky Model A-199 Sikorsky S-55 take off at airport, Dattendorf, Germany, a Sabena stop.

Largest Intercity Copter Operation Grows

Sabena helicopters will carry 75,000 passengers this year; feed traffic to airline's long haul service.

By Alphonse W. Jenson

Brussels—Approximately 75,000 passengers will travel on the helicopter routes of Sabena Belgium World Air Lines this year. This will be nearly lost from the traffic carried in any previous year on the world's largest intercity helicopter network.

Formerly, the increase results from the added capacity provided by a fleet of 12 passenger Sikorsky S-55s now being put into service. Sabena has increased fleet and will have its full fleet of eight S-55s by end of February.

The S-55s replace six Sikorsky S-45s as passenger helicopters. The S-45s have been sold to France for military use.

Another factor increasing helicopter business will be new daily schedules to Paris. Beginning March 5 Sabena will provide three round trip flights to Paris. This schedule will be increased to five round trips on April 15, opening the summer tourist season.

Also in March, Sabena plans to increase helicopter service to Luxembourg and Strasbourg. This may be delayed a few weeks.

In spite of this growth, Sabena ex-

pects to lose more money on its helicopter operations than it has in the past. Discounting the increased traffic which the helicopter routes feed into Sabena's long haul service to the Bel-

gian Congo and across the Atlantic, the helicopter operation is a heavy loss. Operating costs per seat mile with the S-55s is \$1.75; with the S-224.

With the S-55, Sabena expects to cut seat mile costs to two-thirds to four-fifths that of the S-55 or to \$1.15 to \$1.18 per seat mile. But the transportation increase in available seat miles from the larger



SOLID LINES show service in operation, dotted, projected flights, dashed, connecting services.



CHIEF SABENA helicopter pilot M. Genet



Viewpoint at airport, left, and proposed Sabena heliport for 1978 International Exhibition.

Sabena helicopter will create a heavier workload.

Even the much discussed 10 cents per ton-mile cost would not pull Sabena down to a break-even figure as the Schenker operation, according to one executive. A major reason is that last alone is not the primary consideration in Europe that is in the United States. Consequently, loss must be compensated with other forms of surface transportation.

For example, New York Airways can charge \$7 for the short flight from New York International Airport (LGA) to LaGuardia Airport. It's \$5.40 a passenger on bus 4 ticket to Kennedy, a flight scheduled for 79 min and averaging 65 mi. The ticket cost is \$393 per mile.

Against direct loss must be set the gain from feeder service. About 10 to 15% of the helicopter passengers can transact on some Sabena service, according to the profitable long haul carrier.

One Sabena official jokingly suggested that some of the feeder passengers "let him one being operation time another hour." Practically all intra-European feeder services also lose money.

In 1974, the feeder gain was only 15% (AWC Oct. 4, 1974: 22).

Next time Sabena expects a bumper volume of passenger traffic coming to the Brussels 1975 International Exhibition.

It is creating a heliport on the edge of the exhibition grounds. Well over 100,000 passengers will fly with Sabena helicopters during the event, and Sabena hopes an even larger percentage will also travel on at the Atlantic and Channel services.

If the helicopter service adds 10% to the passenger traffic on these long haul routes, it probably will run at a loss.

This will become increasingly apparent as the growth of air traffic continues and as the high-volume jet services begin going into service.

Other European carriers, principally British European Airways and

Sabena's helicopter operation. Whoever develops a major heliport at STOL service within Europe stands a good chance of dominating transportation on the continent in the future. Sabena has a distant lead now in experience with helicopters.

For these reasons, Sabena will continue its helicopter operations despite its high cost.

On its scheduled passenger routes during the 1974 ten months of 1975, Sabena helicopters completed a schedule of 99.1%. During August and September reliability was 95.9%.

With only four helicopters, Sabena flew 1,011 hrs on 157 scheduled routes for an average of 6.11 hr per helicopter per day during August. For the full ten months, the 5-6 hr averaged 5.1 hr per day compared with 4.2 in 1974 and 4.4 in 1975.

At the end of October, the 5-6 hr had totaled 1,654 hr each. The annual utilization figure was estimated at 1,875 hr per helicopter. This utilization rate is higher than that completed by Sabena's Comet 3s.

Since the beginning of helicopter

operations in September 1953, Sabena has flown over 25,000 hrs without loss of an aircraft or injury to passengers. It has averaged one maintenance every 4,000 flying hours.

Capt. Gerard Traverso, chief helicopter pilot, expects the 5-6 hr to improve as on-time satisfaction, service record, his crew better in flight to power intensify. In his opinion, the 5-6 hr is 12 to 15 hr per day for the 5-6 hr, greater current reliability, lower maintenance and better landing altitude. With the 5-6 hr, pilot can fly out, touch down with the tail and settle. On the 5-6 hr, after flying out, he had to land at. This required a more dark month.

Reducing complexity of American military and civilian helicopter operation, Capt. Traverso says, is a little easier.

In his opinion, the 5-6 hr will be the last of the single engine helicopters, but he feels the multi-engine aircraft are still too far away to be counted on.

Another Sabena employee spoke of the current model on the 5-6 hr with two General Electric T18

turbine engines, a two-engine Bell model and the Heli-Bellows in possible candidates.

Until the multi-engine helicopters with together of at least 25 passengers are available, it is clear that growth of Sabena's operations will be slow. Costs charged against it London will not be feasible until then.

Also Sabena will fly round only and not by night or in bad weather as long as it operates single engine aircraft. This obviously is a limiting factor. Consequently the Brussels-Paris service will be the major step in helicopter airline development during the next two to three years. The flight from the Brussels heliport, for example from downtown Brussels, to Place d'Alain in Paris is scheduled for one hour, 45 min. On the Metro night service the first helicopter will take off on minutes to reach Place de la Concorde and take eight minutes to E/Orly.

To attract additional business to long haul routes, one helicopter scheduled will fly from Brussels to London, for example, for 1.5 hr. The flight will be 1.5 hr for the 5-6 hr, 1.2 hr per day for the 5-6 hr, greater current reliability, lower maintenance and better landing altitude. With the 5-6 hr, pilot can fly out, touch down with the tail and settle. On the 5-6 hr, after flying out, he had to land at. This required a more dark month.

BOAC Proposes New Navigation Plan

By L. L. Day

London-Brussels Overseas Airways Corp. hopes to provide scheduled air lines to adopt a uniform track guidance system for jet transports flying the North Atlantic.

BOAC's proposal, backed by data compiled from a series of transatlantic "paper" flights with DC-7Cs and Comet 4Bs, would replace the present system of autonomous flying, which the carrier feels will be unsuitable for jets.

The plan, BOAC says, would permit the operation of jet aircraft at optimum altitudes for maximum performance and with a minimum of traffic delays. An essential of the system would be a long-range radio navigation and tracking track guidance. Among the group's features:

- Restriction of all flights to a limited number of predetermined transatlantic tracks. Number of tracks would depend on the volume and type of traffic and the need for flexible maneuvering to avoid storm areas. Random flying would be abandoned.
- Lateral separation of aircraft. Vertical separation of aircraft is considered essential for high speed aircraft, if only because of long periods of descent at the end of the steep climb procedure or slow descents for instrument navigation.
- Lateral separation of aircraft. Vertical separation of aircraft is considered essential for high speed aircraft, if only because of long periods of descent at the end of the steep climb procedure or slow descents for instrument navigation.

Both BOAC and Comet 4Bs will continue to operate on the BOAC, discount the value of both the Great Circle routes and precise pathing where most pilots fly in addition to their own and standard flight paths. BOAC found that its 374 daily "paper" flights in each direction across

connect Midland (Brussels information) with London and down Paris. It will then be possible to add a Sabena DC-7C from New York and be in downtown Paris in one hour and 45 min.

Other details of the plan of Sabena have been leaked about. The European east-top heliport building has been put aside for several years at least. Instead the old heliport at Alter Vert is being enlarged. A new heliport terminal building is being constructed for use of its heliport will be separate waiting rooms and check-in counters for each major route.

Practically, the plan being designed to fit in with the general philosophy of Sabena that of a total use of schedules on European routes frequent enough that passengers can go to the airport (or heliport) bus, a ticket and travel in less than one hour 15 to 30 min.

Sabena has a new single pilot on the 5-6 hr, in less than 12 min, including four of its training program. It expects to add four or five more later.

The airline believes extensive program automation is useful but not essential.

What BOAC is seeking is a "transmission system" as an navigation that will provide the needed accuracy under all conditions with a minimum of presentation of information to the pilot.

At present, pilots follow no uniform navigation system but normally depend upon Loran, Comair or even external navigation aids such as the T. W. Fels, BOAC control and navigation superintendent, Loran and Comair are adequate for slower turbine engine operation but the uncertainties of these various aids, the cost of operation and frequency problems have led back to the introduction of such units in recent years.

Procedures Outlined

One feels that these navigation procedures are closely related to the carrier's track such as the DC-7C because of the reduced time to make operational decisions. The idea that "an accurate knowledge of geographical position is not necessary for navigation purposes" provided the margin of error of the accuracy of his track and "are elaborate progress along that track at certain times."

Both BOAC and Comet 4Bs will continue to operate on the BOAC, discount the value of both the Great Circle routes and precise pathing where most pilots fly in addition to their own and standard flight paths. BOAC found that its 374 daily "paper" flights in each direction across

this route in preparation for the heavy service during the 1958 exhibition.

Plots fly at a maximum of 55 ft per minute and 1,800 ft per hour.

Training program for the 5-6 hr, includes 40 ft of dual instruction and 30 ft of solo. This is followed by 30 ft of dual and 30 ft of solo. This gives a close supervision on the first 100 ft of the passenger schedule.

There is no question that the heliporter has become a factor in Belgium. Many Belgians who would think of flying to more distant places will head to the heliport instead of the railroad to travel within Belgium or to nearby Germany and Dutch cities. Flying at a low altitude, the helicopter is seen by the public, and the public is not sure of the helicopter's safety. The public is not sure of the helicopter's safety. The public is not sure of the helicopter's safety.

Part of the acceptance is a result of the confidence shown it as it passes overhead. Cords no longer cross the heliport boundaries.

The Atlantic that with frequency of change of routes, 81% of the westbound operations were conducted on only 12 tracks while 57% of the eastbound flights were handled on but five tracks. This constitutes a high number of available tracks can be converted without incurring too great a penalty.

Great Circle Lines

The "paper" flights also disclosed that the Great Circle track and other longer in time and distance than other selected tracks.

Over a four month period, the average time used in selecting a route other than the Great Circle Route averaged 34 min or 10% wasted miles per flight.

The study, however, disclosed that and meeting one specified runway does not necessarily add substantially to the duration of the flight. It also was established that a natural degree of lateral separation resulted from the selection of optimum routing.

The time lost, not only in terms of time but also in terms of fuel and cost, was not as high as was feared. Notwithstanding, there is an extra cost because of fuel consumption in that area.

East Vertical Separation

One wants to see an end to the vertical separation of traffic. The class the controller's job will become far too complicated with vertical separation of high speed aircraft. Using lateral separation of aircraft traveling in opposite



PASSENGERS boarding Sabena Sikorsky S-55 at Brussels heliport.

decisions. The crew, controllers and centers themselves only with over-riding and clearing traffic.

File forecast that the practice of flying at altitudes which provide the best combination of altitude, performance and fuel-mileage will not arrive the introduction of jet transports. The jet will almost choose optimum altitude for maximum performance, he adds.

Both File and Wilcockson endorse the Decca System developed by the Decca Navigation Company of London as a long range navigation aid needed to make the track guidance system possible.

Both airborne and ground units of the system are now available for delivery within four months of ordering, according to the company.

Other features of the system:

- **Complete route coverage** on transoceanic routes is provided by the system through the use of radio aid associated shore stations at each end of the route. The range of the system permits the establishment of the air track BOMC route.

- **System requires** that tracking error be held to five miles on a route length of 1,600 miles and no more than 10 miles at greater distances. Such accuracy will provide the safe lateral separation of aircraft within 10 BOMC.

- **Tracking information** is presented in the pilot in a light log mounted in the cockpit. The log shows tracking on a scope visible to the pilot. The log indicates to an such as levelled error and up to 40 miles to an such as mid-course.

Decca airborne equipment weighs 75 lb. Another 60 lb is added if the flight log is installed. A combined airborne receiver controls operation on both Decca and the standard Decca systems would increase overall weight of the unit approximately 10 lb.

File stresses the importance of the flight meteorological data as provided by the only reliable source of upper atmosphere being continuous life and weather forecasts in some areas particularly the North Atlantic, are somewhat more inaccurate than those received by experts. Differences in planned and actual temperatures will become increasingly important as turbine engines burn because of the direct effect of temperature on fuel consumption and fuel source requirements, he said.

Another factor, File warned, is that fuel reserves on jet transports during normal stages of scheduled service will be somewhat high to make allowance for variable weather and performance. Fueling that could long range flights could high fuel reserves which were progressively reduced as an operational experience was accumulated. He warned that turbine aircraft will be required to follow a similar discipline.

pattern before absolute minimum in service can be established.

BOMC filed two interim reports on its Comet III "paper" operations from London to New York. Both showed paper flights were not conducted because of difficulty in obtaining suitable daily weather forecasts from North American weather bureau.

All interim reports showed that one-stop routing via Keflavik, Iceland, as conceived for the majority of routes selected by operations officials for the Comet operation. In one report, the route was forecast 72% of the time. Good Centre center via Iceland on the southern tip of Iceland was forecast 11% of the savings chosen while London-Gander through New routes were used 9% of the time. Approximately 3% of the flights operated on the London-Gander (two-stop) route, with 1% using other routes.

Average elapsed time in one report

Examiner Proposes Madrid Stop On Pan American's African Route

Washington—Pan American World Airways' application to add Madrid to its South African route has been opposed by a Civil Aeronautics Board examiner. The examiner, however, recommended deletion of the airline's efforts to add the Spanish capital to its transatlantic route.

CAB Examiner Leslie C. Davidson advised the Board to permit Pan American to add Madrid in an intermediate point between Lisbon and Casablanca on its U. S.-South Africa route. He suggested a restriction which would allow the carrier to serve Madrid only on through flights between New York and Johannesburg.

Davidson recommended denial of Pan American's application to add Madrid to its New York-Lisbon-Rio de Janeiro-Buenos Aires route and denial of the airline's request for a new route between San Juan, Puerto Rico, Madrid and Rome.

The examiner favors the addition of Madrid to Pan American's African route as a means of adding economic strength to the route and reducing its subsidy needs. Madrid also will provide a logical transfer point for travelers who want to break up a 40 hr New York-Johannesburg flight. Perhaps recently prohibits the airline from using Lisbon as a stopover point or carrying Lisbon African traffic as a means of protecting the Portuguese National Airline. The last kind restriction, however, is needed by De Gaulle for the Madrid service could be designed to protect Trans World Airlines from diversion of its U. S.-Madrid traffic.

The restriction would keep Pan

Am a two-stage Comet III flight to Keflavik was 10 hr. 59 min. On this routing, maximum payload (17,000 lb.) could have been carried on 76% of the trips and a payload of at least 11,200 lb. on 94% of the flights. On New York when the payload fell below 11,200 lb., a three-stage operation was planned. Average payload on all 64 paper flights was 16,000 lb.

The report also revealed that planned loadings and take-offs at Keflavik could have been made on any occasion while those flights routed via the Maines, would have been forced to divert because of weather.

BOMC does not plan to operate its fleet of 19 Comet IVs as the Atlantic route but will begin Britain's 512 London-New York scheduled service late this year. Comets will be scheduled on the airline's transatlantic route (AW July 21 p. 30). BOMC begins DC-7C non-stop transatlantic service on Jan. 7.

American began operating a frequent U. S.-Madrid service.

Davidson believes that Pan American would have lost \$500,000 worth of business here TWA if it began serving Madrid as its present route.

No-Show Penalty Plan Delayed by Airlines

Washington—Domestic airlines have failed to agree on the penalty phase of the no-show plan which has jeopardized action on the case until April.

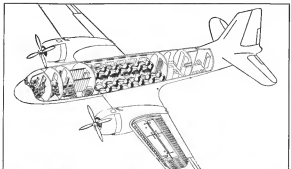
During a two-day session of the Air Traffic Conference, airline representatives expressed such wide differences of opinion on the plan that no formal vote was taken.

In April, a special committee headed by Walter Stoenberg, vice president of National Airlines, will present a draft. The committee favors the addition of imposing some of the differences among the airlines.

The proposed Phase 2 of the no-show plan would impose a financial penalty on no-show passengers and on those who would not break up a 40 hr New York-Johannesburg flight. Perhaps recently prohibits the airline from using Lisbon as a stopover point or carrying Lisbon African traffic as a means of protecting the Portuguese National Airline. The last kind restriction, however, is needed by De Gaulle for the Madrid service could be designed to protect Trans World Airlines from diversion of its U. S.-Madrid traffic.

The restriction would keep Pan

Soviet's Ilyushin Designs New Transports

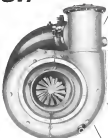


LATEST version of Soviet's two-engine turboprop transport is the Il-14, which Aeroflot is now placing in scheduled operations. The plane clearly resembles other Il-14 models except for a one-meter extension of the fuselage behind the cockpit, where single windows on each side are eliminated. Both the sides are also moved forward one meter; the forward position and buffet on shifted to the tail, and the forward baggage compartment is doubled in size. Despite increased gross weight, the Il-14 is said to be faster than previous Il-14s.



SERGEI YALDINOVICH STUJIN, top Krasnoyarsk designer of attack planes and responsible for the Il-14 (shown) and earlier Il-14 and Il-12 transports, is shown with design office designer Andrei (lower) Mikoyan near Krasnoyarsk's latest aircraft, described by the Russians as a "100 meter." Men behind Stojin and Mikoyan are Chief Designer V. N. Bagdasaryan, probably a cousin of Mikoyan's design staff. Cockpit section (left) is probably a mockup, while fuselage section of the entire (right) suggests the men are sitting in the prototype window, believed to be the Il-12 turboprop transport planned for medium-length routes (AW July 8, p. 26). It is a low wing transport layout with four turboprop engines. Pictures of the designs are first available in more than two years.

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Airline Income and Expenses—November 1956

	Passenger Revenue	Fuel Revenue	Baggage Revenue	Freight Revenue	Subsidy	Total Operating Income	Total Operating Expenses	Net Operating Income
DOMESTIC								
American	\$19,440,370	\$240,387	\$260,727	\$1,497,017		\$22,438,401	\$21,900,000	\$538,401
Boeing	2,413,479	193,880	39,459	91,455		2,747,273	2,698,420	48,853
Capital	4,436,309	109,712	73,831	11,615		4,631,467	4,589,536	41,931
Continental	1,396,486	96,072	18,845	36,324	\$77,384	1,619,112	1,601,000	18,112
Delta	4,730,393	127,975	111,156	174,894		5,044,418	5,001,545	42,873
Eastern	15,254,427	256,233	186,130	275,892		15,972,682	15,811,811	160,871
Northwest	8,551,150	83,844	61,191	107,413		8,803,598	8,748,271	55,327
Northwest	384,273	10,389	2,375	13,819	102,770	413,546	410,904	2,642
Northwest	2,116,110	119,950	49,936	208,379		2,554,375	2,546,510	7,865
Trans World	12,332,348	285,269	91,346	475,139		13,184,102	13,141,685	42,417
United	14,400,787	718,458	321,320	701,487		15,821,572	15,674,204	147,368
Western	2,639,963	67,642	10,347	33,121		2,751,073	2,732,793	18,280
INTERNATIONAL								
American	60,540	8,909		411,284		475,733	426,927	48,806
Boeing	424,023	11,889	159	27,028		446,039	424,431	21,608
Continental Atlantic	169,140	7,746		4,944		181,830	180,387	1,443
Delta	1,011,515	24,844		116,527		1,152,886	1,134,000	18,886
Eastern	193,719	20,894		23,136		238,749	237,811	938
Northwest	293,155	8,444		5,755		307,354	306,704	650
Northwest	1,232,391	27,128		1,759		1,260,278	1,247,441	12,837
Pan American	267,000	12,000		8,100		287,100	286,400	700
Alaska	4,411,000	770,000		8,000		5,189,000	5,189,000	
America	4,355,000	645,000		400,000		5,400,000	5,399,000	1,000
Latin America	4,840,000	448,000		1,100,000		6,388,000	6,387,000	1,000
Passenger	1,201,104	79,343		129,447		1,410,494	1,401,300	9,194
Trans World	2,391,499	384,184		29,440		2,805,123	2,804,760	363
United	679,023	27,713		13,496		720,232	719,306	926
LOCAL SERVICE								
Alaska	271,217	7,437	8,243	132,773		419,670	418,979	691
Boeing	142,547	2,754	3,345	99,500		248,146	247,410	736
Capital	99,537	2,800	3,690	1,818		107,845	107,000	845
Continental	192,342	2,281	3,241	18,011		215,875	215,000	875
Delta	119,363	2,084	2,712	104,261		124,320	124,000	320
Eastern	612,131	4,713	5,173	6,911		628,928	628,000	928
Northwest	478,108	34,202	3,200	128,410		643,920	643,000	920
Ozark	248,259	193,119	3,473	8,550		453,341	453,000	341
Piedmont	263,014	8,231	4,393	3,420		279,058	278,000	1,058
Republic	179,514	7,343	4,185	148,480		339,522	339,000	522
Southwest	311,871	8,428	3,434	102,313		426,046	425,000	1,046
Trans World	249,734	8,216	4,538	5,107		267,595	267,000	595
West Coast	160,223	3,394	3,743	134,281		201,641	201,000	641
FOREIGN								
American	901,482	5,073		54,930		961,485	960,200	1,285
Boeing	112,218	813		6,013		119,044	118,720	324
CARGO LINES								
American	1,000,000			100,000		1,100,000	1,100,000	
Boeing	1,000,000			100,000		1,100,000	1,100,000	
Capital	1,000,000			100,000		1,100,000	1,100,000	
Continental	1,000,000			100,000		1,100,000	1,100,000	
Delta	1,000,000			100,000		1,100,000	1,100,000	
Eastern	1,000,000			100,000		1,100,000	1,100,000	
Northwest	1,000,000			100,000		1,100,000	1,100,000	
Northwest	1,000,000			100,000		1,100,000	1,100,000	
Trans World	1,000,000			100,000		1,100,000	1,100,000	
United	1,000,000			100,000		1,100,000	1,100,000	
Western	1,000,000			100,000		1,100,000	1,100,000	
MAIL CARRIER								
New York	30,944	3,363	1,613	8,806		44,726	44,726	
San Francisco	15,791	1,120	2,097	15,558		34,566	34,566	
Chicago	3,134	4,773				7,907	7,907	
ALASKAN								
Alaska Airlines	103,759	48,784	1,546	60,749		214,838	214,838	
Alaska Coast	33,300	7,412	3,373	27,836		72,921	72,921	
Centuria	14,303	30,435		4,947		49,685	49,685	
The Air Lines	44,474	31,479	320	20,213		96,486	96,486	
Northwest Coast/Alaska	103,759	314,107		81,467		399,333	399,333	
Northwest Coast	21,734	34,127	3,204	78,334		137,399	137,399	
Northwest Coast	65,794	48,139		18,174		132,107	132,107	

*Not available.

Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

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Champagne Flights

WESTERN AIRLINES



RESERVED SEAT



VINTAGE CHAMPAGNE



GRAPES



PAIR MONN

SHORTLINES

► **British Overseas Airways Corp.** flew more than 34 million passengers miles with its Bristol Britannia last year during airlift operations between England and the Middle East and during the refugee airlift between Vienna and England.

► **Canadian Pacific Airlines** will start a second weekly service between Vancouver and Mexico City on Feb. 16. The new flight will connect with Pacific and Latin American services and give Canadian Pacific two DC-6B services a week between Hong Kong, Tokyo, Vancouver, Mexico City, Lima and Caracas Area. Canadian Pacific will carry eight DC-6Bs and five Bristol Britannias on order with British K band RDR-1 airborne radar. It is the first Canadian airline to order airborne radar.

► **Capital Airlines** has opened a new ticket office at Fifth Avenue and 48th St. in New York.

► **Northwest Airlines** will replace its DC-4 equipment with DC-6Bs on Tokyo-Seoul and Tokyo-Hong Kong flights on Feb. 1. The DC-6Bs will carry 12 first-class and 68 tourist passengers.

► **Pan American World Airways** will start direct service between Chicago and Detroit and Fort and Reno on June 2. The airline will operate two round trips a week with conventional class DC-7C equipment. The service will be in effect until Oct. 5.

► **Persia has eliminated its visa requirements** for U. S. citizens, and American travelers can now visit any country in South America without a visa, Panagra reports. After Feb. 1, non-emergency Americans entering Persia will be issued a landing card costing \$2. The card will be available at all consulates and at airline ticket offices.

► **Seattle-Tacoma International Airport** handled 1,256,000 passengers and 32,239,129 lb of freight in 1956, increases of 9% and 9% respectively over the previous year's traffic.

► **Texasients, urban** could more than 137 tons of equipment to help supplies for Hungary from North America to Europe without charge in November and December.

► **Texas-Texas Airways** carried 220,613 passengers, 58,151,235 passenger-miles in 1956, an increase of 46% over 1955 traffic. Passenger load factor was 29.35% last year.

AIRLINE OBSERVER

► **El Al** Israel Airline expects delivery of its three Bristol Britannias some time between May and July and will begin transatlantic service with the new turboprop four seat aircraft. Work on the U. S. will be completed from there to possibly go with the addition of the turboprop aircraft. Negotiations are now under way between the airline and Bristol for the purchase of a fourth Britannia.

► **Northwest Airlines** estimates that one fully loaded round-trip DC-6B flight between Boston and Miami will gross as much revenue for the airline as it could earn over all its New England routes in any one day during off-season, low traffic periods.

► **Western Air Lines** has begun construction of a \$1 million center at Los Angeles to provide housing facilities for pilots, flight engineers and attendants. The two-story, 15,000 sq ft building will be equipped with a \$750,000 flight simulators to train DC-6B crews.

► **Texas-Canada Air Lines** has ordered two Super Constellation for use as interim aircraft on long-range routes until its 4 Douglas DC-6Bs and 28 Lockheed Vanguards are delivered (AW Jan. 7, p. 38).

► **Civil Aeronautics Board** has postponed proceedings in the general passenger fare investigation from July 4 to Feb. 25 when the department is scheduled to schedule a hearing on the exchange in due April 5, to be followed by written testimony on April 22. Trial briefs and oral May 1, and the hearing will be held May 6. American Airlines Continental Air Lines and United Air Lines requested a one-month postponement, and Delta Air Lines asked for a six weeks' deferral. Bureau counsel opposed the requests.

► **Aeroflot and Air France** have again resumed negotiations for a direct air link between Moscow and Paris. The proposed weekly Pelegrin-Moscow-Panama-France service was halted by the Soviet press in evidence of Russia's growing importance in air transportation, but Air France officials are the proposed service will not begin within the foreseeable future. Aeroflot had planned to use Tu-104 jet transports to and from Prague, making connections with Air France for the Prague-Paris segment.

► A bilateral air transport agreement between the U. S. and Iran has been agreed authorizing Iran to operate flights to the U. S. on routes to be determined later. American flag carriers can operate flights from the U. S. to Tehran and Abadan and points beyond. Pan American has been serving Tehran with four flights a week under a provisional arrangement.

► **Five Pan American World Airways** shareholders and two shareholders have received diplomas from Mexico's Restaurant in Paris after completion of a 15-day course in French cuisine and wines. Pan American hopes to improve its service on its first-class Boeing North Atlantic flights to other passengers offered by the better aircraft of other transatlantic carriers, and the group is the first of several courses scheduled to raise the course.

► **Switzer** is operating a 15-passenger Twin Pioneer from Zurich to San Martin and Basel twice a week to serve its ski needed passengers. Since there is no airport at San Martin, the plane lands on the ice in front of the hotel. Three flights a week will be operated by the airline until March 3. On other days the plane is used for a new Zurich-El Chino de Pando-Guayaquil local service.

► **At least one railroad**—the Pennsylvania—is attempting to combat losses to the airlines by distributing tickets among its passengers whenever airline flights are guaranteed forgoing for an "inconvenience" caused by the railroad's arrival of "unexpected guests." The former railroad's system that the railroad is kept "green" when times are clear and adds: "When weather turns bad and airlines stick close to their bargains, we not only have to take care of our regular patron, but of those, too." It concludes with this postscript: "Travel by rail is the best way to get where you're going—in any weather."



First step in '57 toward improved altitude and payload performance

...the new, more
powerful



Now in production is the new Franklin "210", offering dramatic increases in performance for many helicopters now flying with earlier Franklin engines.

The new "210", with 210 h.p. sea-level rating, maintains a full 200 h.p. at 10,000 ft., yielding substantial dividends in payload in mountain or "high country" operations. Hot weather operations are similarly benefited, with 200 h.p. maintained at 11,000 ft.

With 3% additional power, the Franklin "210" actually weighs slightly less than the Franklin "200" now installed in several thousand helicopters, yet it develops its higher output at the same 3200 r.p.m. The potential increase in payload is approximately 120%.

Costing Franklin "200" engines can be modified to produce the new "210" rating at moderate cost. Or a new "210" is interchangeable with your present Franklin engine installation. Write for complete details.

Watch Franklin for more news of great new developments in helicopter power in 1957.

Aircooled Motors

AIRCOOLED MOTORS, INC., STRACUSE, N. Y.

ICAO: Facilities Lag In Southern Europe

Poor-Air navigational facilities and services as much of Southern Europe and its coastline bordering the Eastern Mediterranean are lagging behind other European regions.

That is the conclusion of a special group of ICAO experts who recently viewed up an eight-day working in Paris. The group further reported that present navigational services throughout most of Northern and Western Europe are "generally satisfactory."

The seven-man panel was considering navigational services not only in relation to present radio equipment used, but also in relation to the advent in the future of jet equipment on European routes.

The group singled out the lack of communications between ground stations as one service requiring improvement in Southern Europe and Eastern Mediterranean areas. Another matter which the group thought this region should look into is a more complete network of upper air observation stations.

The establishment of such a network, the panel said, is at the "outmost importance to present-day air transport operations and will be of even greater significance when new high-speed, high altitude jet transport aircraft are introduced on European air routes." The panel expects to discuss this matter with individual European governments.

American Airlines Earns \$18 Million

American Airlines earned \$18,024,000 in 1956, exclusive of profit from property sales, according to a preliminary report by the carrier. Another \$1,540,000 net profit came from the sale of property.

The \$18,024,000 total compares with \$15,695,251 in 1955.

Revenues amounted to \$20,452,866 during 1956, compared with \$18,796,057 the previous year. Expenses totaled \$3,142,776 against \$24,613,393 in 1955.

Earnings during the first three quarters of 1956 were well ahead of 1955's, American President C. B. Smith says.

Increased operating costs and weather problems reduced the fourth quarter earnings to a total below that for the same 1955 period.

Smith said the figures for American and other carriers indicate the airlines have reached the limit of their ability to absorb increasing costs with the present structure of fares.

COCKPIT VIEWPOINT

By Capt. R. C. Robson



Spirit of '56

It is tradition in January to review the accomplishments of the previous year or to look back on the outstanding achievement. The event to be reported here will attempt to do both, but more emphasis will be given to the latter. I believe, result in better transport aircraft and as a more efficient and safer airline operation.

In the autumn of 1955, American Airlines placed on order for second new Lockheed Electra. Shortly thereafter AA called upon its pilot group to form a small committee to study certain specifications concerning the new airplane and make recommendations.

Pilots Called Upon

The first order of business was to flight test the more new requirements, automatic pilot and flight control systems offered by leading manufacturers. Within a few months the Eastern Airlines also ordered Electra and, like AA, called upon its pilots for assistance. Before long the others, United, TWA, Pan American, National, Braniff, etc., followed an identical course. These various pilot groups worked with their own companies and with member firms individually and some formed a composite pilot group to pool ideas and exchange information.

One of the first tangible results of these meetings was the finalization of what has become known as the "T" formation flight instrument panel. According to information available at this writing the CAB can soon approve this design as the standard for the new transports.

Soon the work of these committees turned to other phases of the new equipment—powerplants, systems, controls, etc. During 1956 it was not at all unusual to find three or four teams scattered from one end of the country to the other, busy in heaven or about new transport or related part, attending a ground school, inspecting a factory or flying an airplane.

Yes, you see, it's slightly different. Formerly it had been the practice of airlines to depend upon their own, or the manufacturer's, engineering staff to attend to all the details. The actual engineering people of the airline had practically all been in civilian until they were called upon to use the finished product.

But in 1955 the line pilots, mechanics, stewards and many others got into the act. The result of utilizing this know-how was better airplanes. The airlines should be congratulated on this happy change in attitude.

Reposed Business

The spirited cooperation of the manufacturers should not pass unnoticed either. True, they were making a sale and were trying to win the business. But the airplane manufacturers in the many meetings and pilot groups attended were far beyond a cold business deal. The close collaboration of engineers, engineers and pilot representatives of the manufacturers was of benefit to all concerned.

Any attempt to list the companies who did as well might undoubtedly omit a name or two. Nevertheless these people should receive credit. Besides Lockheed, they include Boeing and Douglas, the Allison and Pratt & Whitney Divisions of General Motors, RCA, Bendix, Sperry, Lear, AEC, Sperry Inc., Collins Radio and many others. The USAF was instrumental in providing data on many aspects of jet operation.

Needless to add that cooperation for the common good is necessary in aviation. By their considered attention to the problems of airline flying these many manufacturers, airlines and other groups have helped assure the success of the industry in the coming years. Better transports and safer flying will reflect the Spirit of '56.



Early flight-test results on . . .

AMERICA'S FIRST SUPERSONIC BOMBER— POWERED BY GENERAL ELECTRIC J79

Fort Worth, Tex. 4—Convair reports that a test flight of the four-jet B-58 bomber has been aborted due to engine disintegration shortly commencing flight testing on November 11. This has broken a 66 records for any such aircraft development program.

Spectacular in appearance and performance, Convair's new B-58 Hustler combines a unique weapons-carrying airframe with four powerful new General Electric J79 turbojets.

Advanced design of the J79 is a prime factor in the Hustler's flight capability. Smaller and lighter than the famous G.E. J47, the J79 today delivers more power per pound than any other turbojet of compressible size. The J79's small frontal area contributes greatly to the low drag characteristics of the delta-winged bomber.

Electric example of U.S. jet progress, the G.E. powered Convair B-58 promises to be the most potent weapons system yet added to bomber squadrons of the U.S. Air Force. General Electric Company, Cincinnati 18, Ohio.



SMALLER, LIGHTER, MUCH MORE POWERFUL than any previous G.E. engine, General Electric's new J79 first went aloft in North American B-45 "Flying Fortresses" (shown) in May, 1955. Engine is now in production for both the B-58 and the Lockheed F-104A.

Progress Is Our Most Important Product

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AAXICO Moves Cautiously in New North-South Air Cargo Route

By Glen Garrison

New York—American Air Export and Import Company is moving cautiously in the development of its new air cargo Route 133, installed by Civil Aeronautics Board in November 1955 for a five-year test period.

Service inaugurated last Nov. 15—year after the CAB decision—now carries New York to New Orleans via Atlanta, three of the 17 cities authorized on AAXICO's points at the north-south portion of the Airflight General Case. The airline reports good south-bound loads from northeastern cities to the mid-gum to the mid-west, in addition to station and equipment. One C-46 roundtrip schedule daily in each direction is presently being flown.

AAXICO's approach to its new service consists through a 23rd of Feb. 1956, when Route 133 was formally installed in the same 1955 CAB decision. Raddie attacked its new route aggressively, moving into more cities in the Jan. 23, 1956 effective date of the revised (AW No. 16, p. 25).

Raddie's situation at the time of the route awards, of course, differed from AAXICO's in that Raddie already was operating a commercial cargo airline and AAXICO was starting from scratch. AAXICO's like Raddie, now has a new five-city route, cargo schedule and new multimillion-dollar Logan coach (AW Jan. 7, p. 25). Other sources at AAXICO see a three-hour weekly south-bound flight to Miami and leaving of some of its C-46 fleet totaling 12 aircraft. Two of the C-46s, in fact, are now leased to Raddie.

First Month

During its first month of operation of the new service, AAXICO's south-bound load seems averaged 85%, according to Glen Stern, vice president of cargo sales. But the north-bound schedule have been running well over 100% and lower load factors. The airline's C-46 can carry a 17-14,000 lb. payload over these segments, Stern says. About 75% of the south-bound traffic is bound for South America and Central America ports via mid-west connections at New Orleans. Air mail and express have helped the south-bound load factors, accounting for 17% of the business, according to Stern.

AAXICO believed the market potential on its new route is that it wants to make use of the business before any writing itself into, leaving, in the Atlanta area, according to Stern, the airline is working hard to develop the

rich potential offered by its new inter-late development since World War II. It describes the new cargo market there as almost untapped, and shippers as unfamiliar with the possibilities of air cargo for their business.

Combination Business

Agreements are being sought with truck lines in the area about 150 miles around Atlanta. AAXICO recently joined the Groups Motor Trucking Association and hopes to talk truck people on the idea of loading up cost-burden business.

Raddie, which also serves Atlanta on its new route to the mid-west, reported 1,850,500 lb. of cargo at that city from the January beginning of service through September 1956. Almost half of the traffic—\$17,187—was in merchandise. Cincinnati, Cleveland, Detroit and Chicago. Unloading at Atlanta through August was reported by Raddie as totaling 1,618,496 lb.

On the other hand, Raddie went into Washington early last year with scheduled service, found that south-bound loads were insufficient, and has pulled out of that city for the time being.

Approach Conservative

Stern admits that AAXICO's approach is more conservative than other all-cargo carriers have been in setting up in new cities and that AAXICO has to mind the pitfalls others have run into.

The airline wants to build its traffic competence at New York Atlanta and New Orleans to the point where it can profit from sales of cargo and express products. Then it will proceed to other cities at other cities on Route 121, which include Philadelphia, Baltimore, Washington, Richmond, Birmingham, Louisville, Chicago, Detroit and Cleveland. No trade in that has been set for serving any of these cities.

AAXICO's equipment plans are not firm at this point. It can just now enter the C-46 fleet into the cargo area when it feels the demand warrants such a shift, and is looking for DC-3s if it can find one at a price it likes.

Meanwhile, according to Stern, the airline's other people are busy getting the ball rolling for the airline as AAXICO sees the picture, i.e. building the traffic that will make expansion probable. One area of effort is the New England textile industry. AAXICO would like to

ship textiles in quantities, to mills in the South and then bring finished clothing back to northeastern markets.

Emergency Business

The oil industry has provided opportunities for AAXICO in the form of parts for boats in the Gulf area. About one of these documents a day have moved on AAXICO, Stern was illustrating the industry line between "emergency" business and normal markets.

Stern cites the difficulty of finding personnel as a major reason AAXICO was slow to start operating over its new route. The airline had been about 56 people to date, according to Stern.

Argentine Airline to Buy Lockheed 1649s

Buenos Aires—Argentine Airlines plans to purchase two 1649 Super Constellation for use on its international route. Delivery could be in mid-1958. Talks are now going on between the Argentine airline and Air France on formation of a pool in which tickets on the two lines could be interchangeable for the Buenos Aires-Argentine route.

This arrangement would connect the present situation in which the French airlines receive a good on flights carrying into Buenos Aires, and had on flights leaving there, while in the case of the Argentine line the reverse is true.

The current talks anticipate that Air France will be responsible for maintenance and overhaul of the Argentine Super Constellation.

The only present service to Argentina Argentine abroad is tourist class in DC-3s. Flights to New York were recently increased from one to two a week, from involving Argentine flag flights abroad. The new Super Constellation flights would be fast days, competing with such lines as KLM and SAS on the European run.

The Argentine line is also planning purchase of two new DC-6s for domestic flights. These will come either from the United Aircraft Corporation or North American Airlines, Inc., who has submitted offers.

Argentine Airlines officials confirm the planned DC-6 purchase, but are not yet a bid to discuss Super Constellation purchases in public. Argentine Foreign Ministry officials, however, confirm the fact that some 54 million dollars have been offered for the new planes for Argentina.

The line now has in operation 6 DC-6s, 5 DC-4s, 4 Constellation 14 DC-3s, 2 C-47s, which are used for cargo, and 7 Super Constellations

C-102 Jet Scrapped By Avro Aircraft

Toronto, Can.—The Avro C-102 jet liner, which made its first flight on August 31, 1946, is being scrapped. The aircraft which took to the air just two weeks after the end of the World War II, never went into production due to the outbreak of the Korean War and the Canadian government's decision to push production of the Avro C-102 form get interrupted.

The jetliner, made by Avro Aircraft Ltd., Toronto, was three years in the making and represented Canadian government investment of \$6,488,561 with Avro spending \$2,317,772 on its construction. The aircraft had been built for possible use by the Canadian government's Trans-Canada Airlines and the Royal Canadian Air Force.

It also was being considered by a number of U.S. airlines at last one of whom, before it had been Eastern Airlines, offered to buy 10. The aircraft flew the 165 air miles from Toronto to New York in 94 minutes with a cargo of mail.

In the past few years the Avro jet liner has been used largely as a research vehicle and observation platform. A series of missions carried it from northern Canada to southern California. It was from the jetliner that Royal Canadian Air Force officials and design engineers witnessed and photographed aircraft flying from the C-102. The aircraft also was used to develop towing equipment for the C-102.

The last engine started on it, a jet engine scrapped in Toronto and some engine is expected to be, with instruments, engines and structural components. The aircraft weighed 26 tons, was designed to carry 30 passengers.

PAT, Aero Finance Certificates Revoked

Washington—Operating authority of Transcontinental Air Transport and Aero Finance has been revoked by the Civil Aeronautics Board for violation of safety regulations.

Under the CAB decision, the two Atlanta-based unsubsidiary airlines operating certificates are revoked effective Feb. 1.

The Board acted in the complaint of the Civil Aeronautics Administration that the two carriers violated air regulations of the Civil Air Regulations at various times in 1955.

Among other violations, the CAA accused the airlines of operating over loaded aircraft, scheduling pilots on fatigued duty, and operating in inclement weather, and in violation of the Civil Air Regulations.

Last October, the chairman in the case filed reports recommending that Aero Finance and Transcontinental's operating certificates be revoked. The two carriers objected to the findings and filed several requests for postponement of procedural deadlines.

The CAB set a final deadline of Nov. 21, 1956, and the current final postponement to the chairman's findings and requested oral arguments before the Board on their objections.

Commenting on the Transcontinental decision, the CAB said the record, the requests for extension of deadlines and the fifteen objections filed lead to the conclusion that they were filed "merely for the purpose of delaying the disposition of this case so as to prevent the carrier from continuing its operations as long as possible." It added.

In view of the seriousness of the

safety violations charged against the respondent (Transcontinental) and the substantial period of time already devoted to the conduct of the entire proceeding, postponing respondent to several further postponements would make a mockery of the Board's rules and frustrate the Board's efforts to discharge its responsibilities with respect to air safety.

The request by the airlines for oral argument was accepted. The CAB said there was no need for it because it would lead to further delay in disposition of the case.

Ethiopian Airline Loan Finances Expansion

Addis Ababa—Ethiopian Airlines will receive a \$24 million credit from the Export-Import Bank of Washington to finance a fleet



Boeing 707 and KC-135s

Boeing KC-135s and the prototype 707 are promised overnight for next day's test program at the Boeing Airplane Co. Flight Test Center in Seattle. Prototype 707, equipped, new but 592 flight hours. Under Boeing name no more are in flight of 11 aircraft which are for latest order production version of the transport. KC-135s in background are first production versions destined for Strategic Air Command use in early program aerial refueling and transport. In its background of picture is a KC-135 in production at Seattle and Wichita divisions of Boeing.



R.E.F. Wan, Dir. of Aircraft Production

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Honeywell
AERONAUTICAL DIVISION

operation and support support program. Part of the team will go towards purchase of two new Douglas DC-48 planes with delivery scheduled in May and June of 1958.

The DC-48s will be used on the carrier's routes between Addis Ababa and Nairobi. Another of the Douglas planes has been ordered by the government-owned airline. Present Ethiopian Airlines fleet comprises eight DC-3s and three Comets 340s.

Some 25 airports in the region now are expected to be improved under the modernization program and additional airports may be opened. Also planned is a study of possible helicopter service to permit relieving mail routes. The airline also will look into possible replacements for its DC-3s, which fly its internal routes.

Ethiopian Airlines carried 379,000 passengers over 244,000,000 passenger miles from 1946 through 1955.

The carrier is operated by Tassir World Airlines management under a contract between IAWA and the Ethiopian government.

Normal service to Cairo on the run to Athens was suspended during the Middle East hostilities last year and has not yet been resumed.

Kaman to Build Nuclear Division in New Mexico

Kaman Aircraft Corp. a new Nuclear Division will be located at Albuquerque, N. M. Vice president and general manager will be Dr. Kenneth W. Erickson, formerly chief of experimental research for the Souda Corp.



LOCAL warehouse workers pack a customer's household furnishings into an efficient unit for light to new home in New Jersey, which suggested plan.

Household Moving Service Start

Shick Airways has inaugurated home household moving service on its scheduled flights, listing the service as a "Sky-Van" alternative container for carrying the goods. A family moving the new plan, Shick says, can move household goods in four or five days at less overall expense than road van service.

The carrier has signed contracts with 10 freelance warehousemen to act as agents for the service. Under the plan, local warehouse workers pack the customer's goods. About four days, the carrier may handle an average 6,000-lb. household shipment.

Minimum shipment is 2,000 lb. and minimum distance 1,000 miles for the service.

Door to door, the customer pays

\$1 to \$2 more per cent for the shipment than he would be paid for car, Shick says, but he would be making up the difference in maintaining his loads for a shorter time between houses.

Moving \$120 for maintaining a load of four for three days, Shick estimates the total cost of a New York-Los Angeles move of a 6,000-lb. household at \$1,170, compared with \$1,215 for a surface route. The surface route would require four maintenance for 12 days at \$40 a day.

Shick's household moving program is managed by Edward E. Brook, a household storage and moving business official before joining the airline last May.



Jack Lower, Chief of Gyro Design at Honeywell Aero, and one of the country's outstanding authorities on floated gyros.

This is Jack Lower, Chief of Gyro Design at Honeywell Aero, and one of the country's outstanding authorities on floated gyros. He and his associates translated an entirely new MIT concept into the world's first mass-produced floated gyro. Jack Lower, the people who work with him, and hundreds of other Honeywell engineers are the backbone of Honeywell Aero leadership in aircraft, missile and rocket control systems.

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Carriers Report Traffic and Revenue Gains Outweigh Costs

Year-end reports from individual airlines combine the overall steady growth of the air transport business with good increases in 1956 and good prospects for 1957 (AWB Dec. 31, p. 32).

The carriers report traffic increases, and revenue gains outweighing the increased costs borne by the airlines. Totals for 1956 as estimated by reporting carriers include:

- United Air Lines earned 6,283,660

passengers, an increase of 37% over 1955. Revenue passenger miles rose up 15% to 4,565,800,000, as freight increased 27% to 51.1 million ton-miles, and mail rose 9% to 28.8 million ton-miles. Cargo was up 4% to 11.3 million ton-miles. United expanded its service to a total of 50 cities, received 130 new aircraft to raise its available tonnage capacity by 14% (UAI president W. A. Peterson predicts a 1957 increase of

5.12% in revenue passenger miles, from 3.6 to 3.675 in freight ton-miles).

- American Airlines carried 7,800,000 passengers 5 billion passenger miles, an increase of 6.7% and 12.7% respectively over 1955. Air freight was up 4% to 7% million ton-miles, and American says it's the world's third airline to exceed 8 million ton-miles in one month (DC carrier). Air mail increased 13% to 37.8 million ton-miles. Air mail totaled 7,800,000 ton-miles, a 13% gain over 1955. Total cargo tonnage was up 7.6%.
- Braniff International Airways reports record operating revenues of \$44,750,190 for the first 11 months of 1956, an increase of 14% over the 1955 period. Net profit for the period was \$1,800,238, a 14% increase. Braniff's revenue passenger total for the period was up 9% to 1,670,600. Revenue passenger-miles were up 15% to 719,499,740. During the year Braniff inaugurated service over its new seven-stage route between Tulsa and the northwest, and its aircraft fleet was augmented by deliveries of five DC-7Cs.
- Western Air Lines recovered from a 74-day strike in early 1956 and carried 52,900,000 in revenue from all sources for the year. Last-quarter losses amounted to \$1.64 a share, but earned \$2.26 a share in net operating profit for the last three quarters, plus \$2.99 a share in equipment sale.
- North Central Airlines carried 549,033 passengers during 1956, showing a record for local-service airlines. This total represents a 25% increase over 1955.
- Mohawk Airlines carried 180,480 passengers during the year, a 26.8% increase. The carrier flew 84,127,190 revenue passenger miles, a 24.4% rise over 1955. Freight was up 16.2% to 1,172,972 lb. and revenue increased 34.1% to 1,365,394 lb. Mohawk expects to carry half a million passengers this year.
- New York Airways carried 89% more passengers in its scheduled helicopter service for a total of 47,074 for the year. Passenger miles rose up 69% to 932,079. Freight was up 25% to 638,340 lb., revenue increased 75% to 1,117,515 lb., but mail was down 12% to 1,135,172 lb. The carrier expects considerably greater increases in 1957 with its new midtown heliport facility and 32 passenger 8-55 aircraft.

Lockheed to Service WV-2 Radar Aircraft

Lockheed Aircraft Service-Intertown, N. Y. International Airport, will provide maintenance services for the Navy's East Coast fleet of WV-2 airborne early warning radar aircraft, special versions of the Super Constellation, in-places work totaling over \$1,300,000.

Western Airlines Ready to Start Los Angeles-Mexico City Service

Los Angeles-Western Air Lines says it can be ready in a short time to re-inaugurate American flag carrier service between Los Angeles and Mexico City as the Mexican government grants its general flight rights to a U. S. company.

Los Angeles Chamber of Commerce recently filed a petition requesting the Congress authorize the approval or revocation of rights of Congression Mexican de Aviacion (CMA) until the Mexican government approves equal rights for a U. S. airline. WAL has held a CMA license to operate the Los Angeles-Mexico City route for more than 10 years but consistently has been denied landing rights in Mexico City by the government of Mexico.

WAL President Torrell C. Drake, says that traffic experts estimate the potential flow of passengers over the route at 90,000 a year. As of now, Pan Western residents must travel by detour routes through Houston in New Orleans if they prefer to fly with an American flag airline to Mexico City.

New York Nonstop

Most night after night which would result from a bilateral agreement would be the nonstop Mexico City-New York City flight on which Air France has been seeking a lucrative monopoly for the past three years.

As bilateral agreements would grant this nonstop route to both a Mexican carrier and one from the U. S. Looking longest among Mexican carriers to get this route is Aeromexico de Mexico. American Airlines admits to only a 50-50 chance but is convinced by evidence as the U. S. carrier must likely to be designated.

Air France feels that the Mexico City-New York route could support three flights each way daily, and would be expected to continue its single flights each way day as long as permitted.

It is expected that the bilateral agreement also would cover reciprocal rights between Mexico City and Los Angeles, New Orleans and Miami as well as various points in Texas.

These is dash coach and first-class non-stop service now to Los Angeles, offered only by a Company Mexican de Aviacion.

Eastern Air Lines wants non-stop rights between Mexico City and New Orleans. That route is being flown now by CMA, which flies to Brownsville, presumably would visit this route.

Great Airways is the only carrier

operating to Miami, connecting with Eastern from New York.

Both Pan American Airways and American Airlines operate between Texas and Mexico City, and it would be expected that Mexican carriers would want one of these routes.

Advocate Equipment

One of the problems heretofore has been that no Mexican carrier had adequate equipment for these larger routes. Now, however, CMA has ordered DC-7Cs. American has leased two Constellation from TWA and is negotiating with Braniff for two Britannias.

Airlines officials agree that the bilateral agreement is a positive step toward aviation but must be an effective that this route which has been hanging fire for 10 years is due for immediate settlement.

But the reason people that Aeromexico will begin the New York flights in February or March.

WAL Builds New Training Facilities

Los Angeles—Grand building construction was held last week (Dec. 15) for a new \$1 million Federal training facility to be constructed by Western Air Lines at the company's Los Angeles International Airport headquarters.

The school's pilots, flight engineers and attendants will receive technical

training in the two-story, 15,000 sq. ft. building prepared in serving on Western's routes covering 47 cities in the 12 western states and Canada. Fixed point of the training center will be a \$750,000 Constellation flight simulator to be used to train pilots and flight engineers on the operation of DC-7B aircraft.

Space requirements of 40 ft. x 40 ft. x 15 ft. for installation of the simulator make it advantageous to locate the building into two sections separated by a brick wall and set-back air space. This design feature eliminates noise and vibration escape from penetrating to the administrative section.

The mechanical section, which houses the modular and other training equipment, will occupy one-third of the building while the larger section of the center will house 1,000 sq. ft. of classroom space, classrooms, a lounge and administrative offices.

Structure was designed by the architectural and engineering firm of Bock, Kober and Nicholas. Construction will be completed by the Bock Corp., general contractor.

The training center is scheduled for dedication on April 17.

Satellite Airlines Take Up MALEV Slack

The destruction of the Hungarian airline monopoly within MALEV during the October-November rebellion has increased the mail volume of the USSR's East German Lufthansa, the Polish



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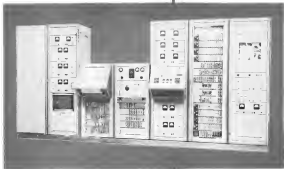
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ICAO Urges Improvement of North Atlantic Traffic Control

Moscow. Need for improvement of air traffic control procedures on North Atlantic routes is the most serious problem facing international aviation, according to a report by the International Civil Aviation Organization (ICAO) set up last week.

The report says the growing volume of civil air traffic over the North Atlantic is already experiencing operational troubles, and that the situation will continue to worsen until fundamental measures for present problems are implemented.

The ICAO group and the main causes of traffic troubles in the area are variable level clearances among Canada, Greenland, Iceland and Shetland, and the lack of coordinated communication, and inadequate position-fixing by aircraft in flight.

Panel Recommendations

In an attempt to relieve the problems the panel made these recommendations:

- Consideration by ICAO members of financing a technique for point-to-point radio communications called "VHF Forward Scatter." The group found this technique, which is not subject to the blockouts that affect present high frequencies, very promising and urged ICAO members to do so. In fact it operates by the summer 1975 if successful evaluation supports it.
- Testing of ground wave communications so that additional ground wave systems can be installed at North Atlantic points where they will help maintain air-ground communications.
- Support by ICAO members of any Civilian aviation plan from the ACADO Air Navigation Commission. Control, a long-range radio beacon, is in operation in the U.S. and Western Europe, but there are gaps in the data across the North Atlantic.

Communications Capabilities

The ICAO panel found that the most heavily-travelled trans-oceanic routes in the world are across the North Atlantic and that traffic has shown substantial growth each year in civil flights. Analysis of the traffic shows that "last minute" cases that hold the civil airlines led serious problems with communications or air traffic services.

The study showed that 40% of the flights could not fly at the altitude they had requested or had to change flight plans when departure because of inadequate control instructions, and that 20% of the flights were delayed on the ground waiting for traffic clearance.

Of the flights reporting on congestion at air control communications on earth, 15% had delays averaging 15 minutes because of congestion.

Of flights reporting on ground communications failures due to radio propagation disturbances, 15% were unable to communicate with air-ground stations for periods ranging from one to two hours, 6% had communications interrupted for less than an hour.

These communications failures control the aircraft and necessitate an end to en route as the Ground Control Area between June and August of last year. The aircraft was not in trouble, but as it is called "out-of-control," when an aircraft is out of touch with the air traffic control center for a specified length of time.

Lockheed Service Receives Contract

Boeing Airlines has awarded a contract to Lockheed Aircraft Service International for major conversion of three Boeing 747-200s from 104H to 104HC configuration.

Included in the conversion will be the installation of wingtip fuel tanks and extensive wing structure and air line modifications.

The present program will be changed, replacing the currently installed Convair Wright R1510 DA-1s for the more powerful DA-3 models.

These modifications will result in increasing the payload range to 600-800 miles and lowering the gross take-off weight from 133,000 lb to 137,500 lb.

Expansion Program Proposed for Denver

Denver-Exempt has recommended a \$30 million expansion program at Stapleton airport, the Denver municipal airport, to enable it to accommodate about 400,000 passengers a year.

The plan was proposed by James C. Buckler, New York Transportation consultant. The report said it would be most economical to expand Stapleton airport to handle the future airlines than to build a new airport at a more distant site.

Mayor Nicholas Annunzio said that he will have to bear the actual cost of the redevelopment program.

The Buckler report placed the cost of extending and reconstructing runways at \$22,300,000.

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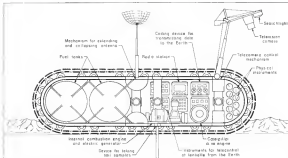


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TAKHTELL LABORATORY designed by Soviet engineers for exploring the outer of the moon

Report Shows Soviet Interest in Space

Robot tanks equipped as mobile laboratories with television cameras and measuring instruments have been proposed as a first step in the exploration of the Moon by Soviet scientist Yu. S. Kikhebrikh.

To place one of these tanks on the Moon would only require a rocket of several hundred tons gross weight, says Kikhebrikh, and the possibility of orbital skidding would reduce that figure to the order of 100 tons.

Several of these robot outposts, controlled by radio from the Earth and transmitting back to it pictures and data from the Moon's surface, could explore the lunar landscape thoroughly before man to make a last landing there.

Kikhebrikh's proposal is one of dozens that have been made in recent months by professional scientists in Russia, including members of the Academy of Sciences, the highest professional phylum in the USSR.

Most of these schemes and views on interplanetary communications, in the spaceflight discipline is called in Russia, are part of the rolling flow of astronomical literature published in the USSR.

Some of them are presented in papers given at astronomical astronomical events which Russian scientists have been attending in increasing numbers.

Three basic schemes probably underlie

the increased Russian effort to publicize their astronomical thinking.

First is propaganda. So-called as specialists to the Moon in Vienna seem a far more precise, scientifically speaking, than establishment of a satellite, particularly a satellite such as the U.S. Vanguard project in which the Department of Defense is cooperating and over which hangs a security blanket. Russian talk of the exploration of space for the betterment of mankind can not be completely objective, but it's a better propaganda line than classifying the Vanguard project.

Second is that mingling with the Western scientific community at meetings and symposia through publicists—embassies adds respectability to Russian and Western knowledge of each other's work.

If a scientific talk of a Moon rocket competition and the way that such a project is possible now, this establishes a benchmark of the state of the art in his home country.

Third, and probably the major reason, is that the Russians have a long and continuing association with the problems of space flight. It has been a respectable scientific area for research and publication much longer than there has been.

This close, long-term association, plus the Russian achievements in other

complex scientific disciplines would almost surely add to a definite recognition in space flight.

This is the only conclusion of the Rand Corporation in its "Guidelines on Soviet Activities" recently issued as research memorandum RM-1708. Project Rand, a staff group whose charter prohibits the handling, transmission, or release of information, awarded Soviet interest in space flight and drew the inevitable conclusion from that interest.

The material that follows is taken directly from that research memorandum. It establishes firmly the fact that Soviet Science has a long record of sincere interest—not merely tolerance of astronomical.

Russia's rich historical background in astronomy began at the end of the 15th Century with two cloned works: I. V. Vsevolodskiy on the dynamics of bodies of variable nature, and K. E. Tsel'nikov on the various principles of rocket flight.

Tsel'nikov's disciples established a complete scientific organization—called GIRD after the initials for the Russian words for "Group for the Study of Reaction Motors"—in 1929 for investigating and developing systematically new rocket designs. The Moscow branch—MGIK—was founded by Engineer I. P. Forstov and the Leningrad branch—

Leningrad—was organized by Prof. N. A. Rybn and Dr. Ya. I. Piont'va.

(That same year, the German Army Ordnance Dept. made its decision to get into the rocket business, with the well-known result. Goddard's first rocket flight had been made three years before, and his first large liquid-propelled rocket was to be launched the following year.—Ed.)

The Soviet official sponsorship of rocketry had to wait until 1914, but it was eight years ahead of the last systematic sponsorship of rocket development in this country by the Army.

Stable and good personal interest in language rocket interests, according to many reliable reports from Russian sources.

Post-War Interest

Russia acquired most of the German rocket factories and test stands in the postwar seizure of Germany, and received about 200 Germans to work for them.

They have built probably several thousand V-2 missiles, presumably for fundamental rocket and atmospheric research, for experience in producing big missiles, and for training launching crews.

Russian scientists improved the V-2 powerplant by increasing the propellant flow, so that the thrust was increased from 25,000 lb. to 27,000 lb.

(The scale of development was also achieved by North American designers in this country in developing a Jove V-2 engine to approximately the same thrust.—Ed.)

The Russians have been working on a rocket called Model 107 which has a thrust of 25,000 lb. at a chamber pressure of 880 psi.

Developments such as these indicate that Russia's effort is more than an exploitation of German work and that it is based on independent research.

This is not surprising because Russia has exceptionally capable technical men, such as Serouss and Zeldovich in combustion and Kikhebrikh and Sedov in aerodynamics.

Authoritative View

Alexander N. Nesmeyanov, president of the Russian Academy of Sciences, said to the Moscow Press Council in Moscow on November 1955.

Science has reached a state when it is feasible to send a stratosphere to the moon, to create an artificial satellite of the Earth, when effective methods were have been found for testing in space—the most detailed sources of mankind, and when the problems of energies have reached completely new horizons.

This statement is particularly interesting in view of the events that followed, such as the aviation of Soviet

advisers in nuclear reactor technology. It is a significant statement because it is authoritative. Nesmeyanov is familiar with all aspects of Soviet scientific progress as its official capacity, his statement implies that Russian progress in rocket propulsion had made feasible, the satellite and the Moon rocket.

Following Nesmeyanov came a flood of spaceflight articles in almost every Russian newspaper and periodical. After the U.S. announcement of the JCV satellite program in July 1955, this flood was substantially augmented by articles discussing satellites.

(At this stage, Rand scientists felt that a further look into the area of

Soviet interplanetary communications might be revealing. They began to collect and collate Russian published material available in this country in the Library of Congress and from other sources. The Rand interplanetary—by F. J. Kruger—contains a 230-page bibliography and a series of 18 complete translations of papers by Russian authorities selected for a better understanding of their techniques in developing the subject in open literature and better acquaintance with some of the personnel associated with making the official position clear.—Ed.)

The Rand Memorandum 340, its factors as of primary interest in say



Snark Flight, Ground Tests

Northrop Snark SM-62 intercontinental jet bomber, climbing for a high altitude test flight (above), will go into operational service as a limited base with SAC in about a year. Ground tests are conducted on Snarks (below) at Wright Air Development Center Laboratory. These tests, which begin in October, will continue through February. Forward by Post & Whitely [10 pages, which are delivered without any transmission. Forward: Two rocket boost Snark of mobile launcher, and vehicle slides to high altitude where it reaches Mach 0.9 cruise (AW Feb 23, p. 31)



evaluation of Soviet astronautical competence.

• **Russia has lost** and still has its share of space-flight engineers. K. E. Tyukolkin, the father of the science of astronautics, finished his last complete work—The Exploration of Cosmic Space by Kozlov—in 1959. But he had contemporaries who also contributed much.

E. A. Tsiolkovski developed the idea of using as fuel the metallic components of a rocket ship as they become unnecessary during a flight to other bodies and successfully built a rocket motor using kerosene and liquid oxygen in 1932, and investigated metallic fuels in rockets.

Yu. V. Kondratyuk proposed the use of atoms as an oxidant and the idea of astronautics looking for a rocket returning to Earth. N. A. Rarov published a monumental astronautical treatise on interplanetary communication from between 1928 and 1932.

Yu. I. Bondarenko and L. P. Frenkel, among other things, founded the Russian rocket society GIRD.

Rocketry Literature

Among the available and public publications for the Russian rocket service are: M. K. Tikhonov and A. A. Shkredtchik in the post-Tyukolkin era, and more recently, D. V. Lyapunov, K.

Y. Yulizar and Yu. S. Klibitchevich.

• **Russia has** a well established literature on rockets and space flight. This includes the classic works of Russian poets, and translations of foreign monographs by Konstantin Petrov, Oberth, Hermann Gossard, Senger and others. Very recently of Gossard's technical data was included at the end of the work.

Since 1957 Russia has been publishing a monthly rocket technology journal devoted to translations and contents of foreign periodicals. The Academy of Sciences began in 1954 to publish a journal of advances from foreign and domestic publications on rockets. This also lists their own classified literature.

• There has been an increasing number of articles in the problems of space flight in recent years. The Soviet news papers and magazines feature more and more articles written by well-known and famous and top-notch scientists. Thus, no writer is to publish, first, the technical contribution of Russian progress, next the results of foreign tests, next the problems of launching a satellite and, last, the importance of the data, and finally a hint at the great efforts of Soviet scientists to make cosmic flights for peaceful purposes. There is almost a fixation of specific Soviet developments.

For example, the Large Soviet Encyclopedia lists two tables of rocket

characteristics. One dates liquid-fuel rockets including the German V-2 and V-2s, the U.S. Viking 2, Atlas and Scout, and the French Véronique. The second table presents the characteristics of some missiles, including the German Rheintochter and a 75-ton Impregator shell, the U.S. Wright and the Soviet Sparrow.

Recent Russian literature has become highly specialized considering such subjects as astronautics, radiocontrol, aerodynamics, surface hazards and the problems of the ICJ. These times have become more conservative in the West, and the old idea of capitalist competition is absent.

• Specific times indicate official interest in space flight and some has penetrated in the specific program. The head of the Soviet Embassy in the United Kingdom, Gold Wolf in Sept. 1954 to be awarded once every three years to the winner of the most outstanding work on space flight.

Permanent Commission

A permanent interdepartmental Commission on Interplanetary Communication was established under the Administrative Council of the Academy of Sciences in April 1955. Chairman is Academician R. I. Solov'ev, members include Academician P. L. Kapitsa and V. A. Arshinovskiy, Corresponding

Member of the Academy P. P. Pargin, doctor of physics and M. B. V. Kozlov.

One of the immediate tasks of the commission, said the newspaper Evening Moscow, "is to organize work concerned with building an astronautical laboratory for scientific research in space."

It is believed General Secretary of the USSR, organized an Astronautics Section headed by N. A. B. Varnov.

(This group has quasi-official status and is important politically and scientifically as well as technically—Ed.)

Among the members: Prof. V. V. Dobrovolskiy, Engineer-Designer J. A. Markov, (rocket system), A. D. Sevgin (cosmos flight), Prof. K. P. Stukolov (rocket launch), U. S. Chibrikov (radio control) and A. A. Shkredtchik.

(Scientists after the names indicate the specialized field of each man—Ed.)

There are repeated references to a Man-moon project. One early attempt was a study by M. K. Tikhonov, probably a ballistics man, who gave calculated data for a Moon rocket in Pionerskaya Pravda for Oct. 2, 1951. Kozlov's Plan for Oct. 12, 1951, says that a Moon rocket design has been developed. The rocket is 190 ft high, has a maximum diameter of 49 ft, weighs 2,200,000 lb. and has 20 stages with a total rating of 150 million thrust horsepower.

Problems and Hazards

A recent project is the task-laboratory described by Klibitchevich in an article called "The Road to the Cosmos."

After reviewing the problems and hazards of manned space flight as the first step, the author suggests the next-best approach.

He says: "A robot controlled by radio from the Earth will land on the Moon, instead of a crew, a mobile laboratory which internally somewhat resembles a small tank. This tank-laboratory will also be controlled from the earth."

"The transmitting television camera, mounted on a radio-controlled beam having several degrees of freedom and fixed on the tank-laboratory, will provide reports on the Earth to check the lunar surface and the lunar sky with the disk of our planet visible on it (all this can be photographed on the Earth), and to determine the exact path for the movement of the laboratory."

"About it will be placed various automatic instruments transmitting to the Earth their readings on the state and properties of the lunar atmosphere and the lunar surface. For moving the tank-lab and operating its equipment,

the necessary store of fuel and oxidant for the engine will be available. Unlike that of other known sources of energy, it is possible. Calculations show that for a tank-lab laboratory with a total weight of not more than one million dead kilograms, various initial movements of the Moon, sufficient for a starting out the way—stage—the motion of the Moon by man are possible in principle, and what is more, in case of necessity, it will be possible to land other tank-labs, taking into account the results obtained earlier."

Klibitchevich's Conclusion

Klibitchevich concludes with this statement: "Mastery of the Moon by means of radio controlled rockets and tank-labs."

The scientific publications of the

laboratories will open up new possibilities and will not encounter fundamental difficulties from either gas or radiative control technology. That is why in the next few to ten years the conquest of our nearest celestial body can become a fact."

• The coming of age and present rapidity of astronautics are becoming facts. There is considerable evidence of the official acceptance of space flight by the Soviet hierarchy. For example, Vol. 27 of the Large Soviet Encyclopedia published in June 1954 has an article entitled Interplanetary Communication by M. K. Tikhonov and D. V. Lyapunov. There is no corresponding entry in one of the best cosmo-encyclopedias as yet.

The scientific publications of the



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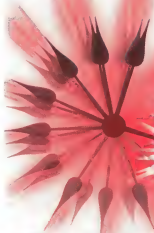
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New Falcon Version

GUARD Falcon is latest version of the Hughes atomic engine. Falcon is radio-guided, and will carry Convair F-102A and Northrop F-105B as motor for Falcon GAB-1 models. Model is slightly larger than its first, has a diameter of about six inches. Major external difference is in control surfaces, now separated from the fuselage by a large gap. Improved nozzle walls include better guidance and increased efficiency for the Thielert solid propellant motor.



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Academy of Sciences—which is spite of its historical lapse into Lysenkoism is an internationally respected body—have accurately presented articles on the problems of space flight. One of these was a survey of the state of the art as gathered from the papers of the Fifth and Sixth International Astronautical Congresses.

That survey concludes by quoting Andrei Kagan:

"If in our branch of knowledge the possibilities of constructing a new, large field of investigation are opening, then it must be done without fail, because the history of science teaches that, as a rule, it is precisely this penetration of new fields that leads to the discovery of those very important phenomena of nature which soon capture earth and enter the paths of the development of human culture."

The Rand Memorandum closes with the observation that the Russians have not reached a positive historical verdict in astronomy, but a positive scientific interest in the field. If these achievements in aviation, nuclear technology, and what they call volcanoes and telecommunication, in addition to their known achievements in rocket technology are indications of their competence in these fields, then it is more than likely that, because of their penchant for capitalizing on grandiose schemes, they have a delivery competence in interplanetary communications.

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For data write: International Nickel Co., 67 Wall Street, N.Y. 5, N.Y.

Defense Team Visits Northrop and Snark

Headquarters, Calif.—A team of Defense Department executives and officials, headed by Dr. C. C. Farnus, Assistant Secretary of Defense for Research and Development, visited Northrop Aircraft, Inc. for briefings on

weapons under development at Hawthorne.

Discussed were the company's plans now on the Snark, intercontinental guided missile, the T-38 supersonic jet training aircraft, and other yet unnamed source weapons systems programs.

USAF Announces Missile Contracts

Washington—USAF announced contracts for the design, fabrication and testing of hardware for three missiles:

•Atlas, by Convair Division, General Dynamics Corp., San Diego, Calif.,

\$141 million. Actual total of Air Force contracts for the Atlas is over \$500 million.

•Titan, by the Glenn L. Martin Co., Downey, Calif., \$336 million.

•Thor, by Douglas Aircraft Co., Santa Monica, Calif., \$67.5 million.

The Atlas and Thor projects are interrelated ballistic missiles (ICBM).

The Thor is an intermediate range ballistic missile (IRBM).

USAF and the contractors are now planning for the contracts are cost-plus-fixed-fee agreements, replacing letters of intent under which the projects have proceeded to date. Contracts for other missiles are being negotiated.



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GRUMMAN F9F-8 in Training Command color has nose probe for prebaked design checking. Longest flight duration and stresses are obliged Grumman to use liquid rather than gaseous oxygen supply to save space.

Cougar Doubles as Fighter-Trainer

By Russell Hawken

Redesign, L. L. N. Y.—Grumman Aircraft Engineering Corp. is optimistic about the chance of its F9F-8T to get top billing as an advanced fighter-trainer for Naval Air Training Command. The case for the two-seat Cougar is based on the Grumman claim that it meets closely parallel the handling and performance of upcoming Navy fighters three times

its chief competitors, the Lockheed T2V. Grumman engineers say the idea was conceived in response to a request from the flight instructor of the Bureau of Aeronautics for a plane which could double as an operational fighter and check out trainees to be assigned to fleet squadrons using the basic single-seat F9F-8. Modifications of the basic Dash Eight had to meet the special requirements for a Navy trainer without

compromising the airplane's performance as a fighter.

An order for 156 of them is now in production. All of these were originally intended for fleet squadrons but full basic bases given to the Training Command in the fleet program to replace the Cougars with later design fighters. The first 26 airplanes will be delivered shortly, about a year after the first flight of the prototype. Production is expected to reach the planned rate of 15 per month some time this spring. The air will be finished by December but Grumman hopes for follow-on orders.

Cost of the modification of the Dash Eight in terms of gross weight was only about 400 lb., despite the addition of another cockpit and pilot, longer nose and a certain amount of fuel-up. The length of the F9F-8T is 34 ft., more than that of the single-seat version.

Structural Demands

Plan to give certain qualifications training in the new version demanded a structure strong enough to make a total loadup at weights very close to maximum safe-lift gross. The single-seater was designed with the intention that it would come aboard for its first landing at a relatively light weight after spending most of its fuel according to a typical mission.

To cope with heavy dock loadings, the landing gear shock struts and the



UPWARD SWINGING HATCHES give access to nose-mounted oxygen gas. Two downward swinging hatches (not shown) serve gun. In adjacent version, whole nose side forward of windshield detaches for equipment servicing.

landing strut-through structure from the tail hook were beefed up. Main wheel size was increased to 27 x 6 from 24 x 5.5. The hookers were redesigned to allow the shock strut take in training operations. An automatic friction adjuster pulls the brake piston back .056 in after application. As a result, solid and gelatin based unitary unitary Brinell of reduced brake drag, the landing change into a down to 100 stops per change. To cut maintenance time and cost, a quickly replaceable suspension was provided by Goodrich. Self-unlocked in the position of brake drag caused by shoe wiping from the heat of friction.

Dock Handling Convenience

A mechanical up-lift for the tail had been installed for convenience in dock handling. The tail hookers clear the dock when it is extended and the plane is in the static attitude. Tail models in the F9F series had no up-lift, and the tail was automatically retracted by operation of 9000 power or retraction of wheels.

Weight and space limitations cut the number of 30 amp M-1 cannons from four to two. Ammunition supply was reduced slightly to 100 rounds per gun.

Removal of the 12 cannons in the gun blast tubes produced a deep, pipe vapor zone and vibration which could be felt in the added joints and the floor when the prototype exceeded 250 kn. The engineering staff first tried to correct the trouble in redesigning the diaphragm gun ports. It was finally fixed

by forcing a pipe into the aft end of the blast tube. The length of the "T" pipe is equal to that of the blast tube and apparently the equal resonant frequencies in 180 degree out of phase with that of the blast tube.

The guns and associated avionics gear are serviced from three access doors on each side of the long nose. One gives access to the cannons; the spot shell cover and ammo links. In earlier models of the F9F across the whole nose door did not allow a place to expose the equipment for servicing.

Increased oxygen needed by a two man crew on long missions possible with in-flight refueling is supplied with cut-increasing space requirements by

using liquid rather than gaseous oxygen. The tank and its accessories fit into the same arrangement formerly used for gaseous oxygen bottles in earlier versions.

Sliding Canopy

Long sliding canopy was chosen for F9F-8T in preference to clear-shell used in F9F. Grumman considers this configuration to be the best answer to Navy's desire for a canopy which will open under water at the event of a ditching from low altitude. Unlike the clear-shell canopy, it does not have to push a great mass of water out of the way to open.

Another reason for the sliding canopy



LONG CANOPY slides off, with Navy preference for canopy-open takeoffs and landings. Open canopy doesn't limit directional stability.



IN ESCAPE canopy slides rather than ejects, under escape seats and under water. Back seat windshield pivots forward in emergency landings, landings.

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One of GPL's ground speed and drift angle measuring equipments, AN/APN 81, provides basic input information to computers which tell Air Force F-4s exactly where they are

every flight second. GPL's auto navigation gives a continuous and continuous display of Ground Speed and Drift Angle, Wind Speed and direction, Longitude and Latitude, Altitude, Time To Destination, Bearing Signal To Plan (en route).

The systems were developed for the Air Force (WADC). They are the result of an achievement comparable in

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and many types of military aircraft, these remarkable GPL systems will, one day soon, make flying safer, more convenient and more economical for everyone.



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ENGINEERS = GPL engineers have spent up some unusual research and development opportunities. And round to Patent Storage.

inside outside disconnects it if the stick is moved forward more than 15° so as to save them 40 lbs. of pressure is applied to either or both pedals. Some pilots increase maneuver when the one deeper causes the pedals to move under their feet.

It can be cut off outside if this is the case.

The less and more control of the control of gravity caused by the long run has improved stall handling by making the nose drop rapidly in the stall.

Full throttle is still needed in takeoff and landing to give the wingwing design adequate control in a crosswind. Some systems are made by controlling the controls.

The system has no sensors. All lateral control is provided by speakers in the upper wing surface. This eliminates the danger of control reversal caused by twisting of the wing when sensors are deflected and provides better control of high Mach numbers.

Vickers-Armstrong New Design Team

London-Vickers-Armstrong is now gaining its design team.

Although overall technical direction will remain in the hands of Managing Director George Edwards. New appointments provide for separate direction of each of the firm's three main fields—civil aircraft, military aircraft and guided weapons.

Head Stephenson has been named chief engineer for civil aircraft. H. H. Gordon, chief engineer for military aircraft, and B. J. Clouston, chief engineer for guided weapons.

The company expresses the belief that divergence between civil and military aircraft is increasing.

For that reason, the appointment of "the appointment of a chief engineer for civil aircraft has become essential. On the military side the modern trend is toward the weapon system concept and Mr. H. H. Gordon's appointment to chief engineer for guided weapons, coupled with his general aircraft design background, is of particular and valuable significance."

Gordon previously was Vickers chief designer for guided weapons and Stephenson was chief aircraft designer at the Westinghouse plant.

Reginald Clouston is a director of guided weapons projects at the Ministry of Supply. He will take over his duties at Vickers in April.

In other aircraft resulting from the re-organization, G. F. H. Rowley becomes assistant chief engineer (aircraft), David Jones, chief designer aircraft (Westinghouse), A. N. Schibler, chief design aircraft (Supermarine) and E. W. J. Gray, designer aircraft (Hawker).



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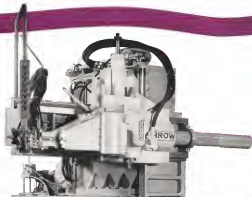
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For swarf or twist machining, a second tracing valve is installed and the spindle is moved on an arc-shaped way. A swarf of over 20° either side of centerline can be machined.

Write for Bulletin PR-156. Get full information on this low cost answer to your contouring, pocketing and swarfing problems.



ARROW ENGINEERING COMPANY, INC., 329 East Market Street, Indianapolis, Indiana



A LARGE assembly floor for the SeaMaster off-hull crane is being set up in the Go-a aircraft tooling assembly area. Behind it, SeaMaster bulkhead assemblies and drilling fixtures are being fabricated. The seven or eight toolers in the area have had more previous aircraft or related tooling experience.

SeaMaster Tooling Nearly Complete

Proof of steadfast Navy backing for Martin POM SeaMaster program is completion of the jet-powered flying boat's tooling. R. Hae de Go, Bronx, N. Y., is just now winding up its \$2 million plus contribution to SeaMaster production tooling. Hae is one of 50 subcontractors in the tooling program.

The only considerations are said to have been due to Martin's attempt to rehabilitate the tooling work, load among its own shops and those of its subcontractors so that the new SeaMaster could be built on the production tooling. The third SeaMaster is sought to reinforce the flight test program twice aborted by the crash of the two previous SeaMaster prototypes. There is also some talk that the tooling for the full section has been frozen pending a "hard-up" redesign which will thicken the sections. The crashes, however, were due to faulty control inputs rather than structural weaknesses.

When Hae first got into aircraft tooling at the SeaMaster job and a half ago, it had no previous experience in aircraft tooling. The company's sub-

sequent performance, up to the rate of 1,500 tools (of all sizes) per year, was due to its "leave-on-drifting" approach. Arthur Gordon, production manager, told Armstrong Wicks.

Lack of know-how was overcome by adding a nucleus of up to 40 aircraft tool designers and having these men

"frustrated" and detail their designs down to the point where the details could be cut off the room drawings and coated through the Hae machine design the same as any other work.

Despite a steady year of "help-wanted" advertising in the newspapers, most of the top 10% of the men had to



HAE tried that the objection of the design department prevented them to successfully enter aircraft tooling without previous experience. During the peak of the SeaMaster program 10% of the men were "jobbed."



FOXTURE for the hull chair legman had a curved and twisted shape. The said it was one of their most difficult tools.

be "job-shopped" from a Philadelphia source and some of these men, after the practice which used in the aircraft industry, as per design from allowances for the duration of the job. These men plus their hand by Hae brought the aircraft tooling experience to the firm and were able to translate this knowledge into detailed drawings in language familiar to Hae customers.

Thus the aircraft tool parts could be fed through the machine shops along with the main Hae line of large parting press parts and hand-machined castings as well as other subcontracting jobs (Hae has an order for million worth of 36 different parts for the Chance-Vought F50).

Compared to the usual aircraft company's toolmaking methods, Hae's sys-

tem definitely rates the drafting, tooling, and tool making as a group tool design engineer, but it does make it possible for an industrial firm like Hae to get in on a specialized job such as aircraft toolmaking. Actually, the approach is not new. Edward Carter, tooling government, Martin, said, it is more a matter of degree than novelty. "Hae and Alfred Hoffman, West New York, N. J., mostly Martin tooling subcontractors, are both examples of older firms which have always had to live with precision work. Hae with printing presses and Hoffman with textile machinery," said Carter. "It was only natural for Martin to look to such firms for large tools."

In times of national emergency the "leave-on-drifting" philosophy could be extended to top the experts of more other firms who had never handled aircraft tooling, Hae said. With the Defense Department's post-war posture emphasis upon perfecting tooling programs with tight test evaluations this type of production concept becomes more important.

One obvious drawback is that while a master toolmaker is able to work from sketches (thinking has job) out as he goes from machine to machine creating the tool he subsequently makes and files, in the Hae method an error in the fragmented drawing goes through all the machine shops. When the mistake is discovered in final assembly, it is a hurry to correct. Hae recognizes estimate that on the average tool, it takes about 60% doing drafting time, but that they are able to save 12% of more expensive machine time.

In performance, the engineers add that that method can correct itself to expedite the Martin plant's time (usually on the order of the number of tools made, but they say that this has made most of that up on the single tool).

Aircraft tooling has accounted for up to 15-20% of the total plant load of 32,000 man-hours per week.

Hae was aircraft subcontracting to aircraft plant production and about the very narrow profit margin in the printing press industry, according to a new press was consistent. It has been making printing press since 1886 (this suggests a pointed on one of its more recent designs—a high speed rotary type). It started doing government defense work in 1947 when it got a contract for a 3 in. diameter for the Navy.

At the time of the last SeaMaster crash in November, that of the SP6M-1 (AW No. 18, p. 36) it was stated the accident would not affect the Navy's plans to buy six prototypes and 24 production models.

The model in the second crash took off from Martin Airport at Middle River, Md., early in November on a



EXAMPLE of the use of machine which a booming industry in order to two out tooling for large modern high performance aircraft. Hae was that "frustration" then tooling into detail tested in particular machine has permitted them to substitute their SeaMaster tooling work in with their other machine jobs and keep early machine down time to a minimum.



EXAMPLE of the depot in which the duPonts "supermarket" a bulkhead from. Taking the basic tool design from Martin this have developed the part detail, seen in the left hand side of the drawing, to the point that there can be cut off from the main drawing and individually traced through the machine shops for production.



Heat treatment directs the milling of a bulkhead clamp block.



ASSEMBLY mid-40s fixture for simulating ball pressure bulkhead being assembled. The parts are assembled on the assembly base on which the left layout has been reproduced photographically.

crash test flight. Fifty-one minutes after bailout over the town of Orléans, Del., south of Wilmington, the plane was flying approximately level at an altitude of about 21,000 ft and a speed of about Mach 1.4.

Suddenly it went into a tight right turn against the full opposite control by the pilot.

The plane fell off into a downward spiral and broke up at approximately 9,000 ft.

The pilot, copilot and two flight engineers—all Martin employees—quitted watch.

In the crash of the first model, Dec. 7, 1952, a Navy pilot and three Martin engineers were killed.

Martin engineers and the Navy concluded after the first crash that a malfunction of the control system caused the horizontal tail to turn up and suddenly throwing the plane into the beginning of an outside loop.

The three Martin team which investigated the first crash landed the second, and due to the crewmen's severity and the salvaging of some parts of the second investigation has been easier.

The investigators have been trying to tie the two similar control malfunctions together.

They are reported ready to present their findings and suggestions tomorrow to the Navy.

Meanwhile, Aerojet Manufacturing Corp., Middletown, Okla., is continuing work on prototype manufacturing program to supply the Bell-Bell with vehicle handling, duties so that the plane will be independent of personnel type supplies, bases.

Aerojet engineers conducted towing tests last week at the Stevens Institute, Hoboken, New Jersey.

Aluminum Fuel Is Tested for Jet Engines

Treatable aluminum is being prepared by U. S. Industrial Chemicals Co. in pilot plant quantities.

A light, flammable liquid which ignites spontaneously in air, treatable aluminum is now being tested as a fuel and injector for jet and turbo-jet engines.

The aluminum fuel also has possible application in a polymeric fuel system and is an intermediate for chemical synthesis.

Also available from the pilot plant is methyl aluminum isopropylate, a mixture of methyl aluminum dichloride and dimethyl aluminum chloride. This, too, may find use as a catalyst in chemical synthesis.

These products are being prepared on a pilot plant scale at Laurel, Md., the site of U.S.I.'s subsidiary, Manulco Corporation.

French Agree to Merger of Air Firms

Paris-French government approved without public debate the merger between Sud Est Aviation and Ouest Aviation (AW) Jan. 14 p. 25.

A decision signed by Finance Minister M. Laniel authorized the merger between the two big state-owned airline companies. New company name will be Sud Aviation.

Georges Harel, president of Sud Est, will hold the top post in new company. Georges Glusac, Ouest Aviation president, though leaving industry for another job, will remain as chairman and vice president of combined company.

Despite a certain amount of grumbling in industry and press, no formal opposition was made to the merger which was quietly pushed through at top level.

New company will number some 12,000 workers in nine factories. Only other remaining state airline concern is the Nord company which, despite industry rumors, government assets will not be merged into Sud Aviation. Nord employs some 5,000 workers.

Shortly after government published its decree, Harel issued statement in which he said the merger is aimed at concentrating the state airline assets to their "base" can be done. He noted that the new company marks a new step among world's national airlines.

Decree authorizing merger states that for a period of three years the number of management personnel can exceed the limit set by previous law. That "job saving clause" was put in to help ease the new company over its transitional stage.

Westinghouse Uses Neutrons in New Test

A new method of probing the crystalline structure of metals with a beam of neutrons, which is 100 times better and more sensitive than previous methods, has been perfected by Westinghouse scientists.

In proving through crystalline structure, a beam of neutrons is deflected by the stress in the crystal. Westinghouse says that, until now there has been considerable difficulty in getting a satisfactory picture of deformed material. Exposure of more hours and exposure with standard sources of neutrons. A Westinghouse scientist said.

Our technique shows this three or four times. We expect to extend the usefulness of neutron diffraction for the study of crystal structure.

Neutrons will reveal the crystalline structure of many thousands of

different materials which are either transparent or opaque to x-rays with X-rays, which is a traditional method of probing the structure of crystals.

The Westinghouse technique was developed in cooperation with the Oak Ridge National Laboratory. Secret of the new Westinghouse technique, the company says, is an improved method of making sensitive "visible" to photo graphic film.

Westinghouse adds that "in a test, our scientists have obtained the first neutron powder diffraction patterns ever known."

After being "scattered" by a crystal,

the neutrons are allowed to strike a special fluorescent screen placed next to the film.

The screen is made by sandwiching a phosphor in a thin layer of special glass or plastic which contains atoms of boron.

The neutron pass through the photographic film and strike the screen where they smash into the boron atoms.

This releases tiny powerful atomic particles which cause flashes of light on the screen. These flashes are recorded by the photographic film, giving an exact picture of the diffracted neutrons. This new method is called



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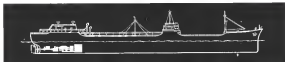
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EQUIPMENT

Old-Type Shaft Seal Adapts to Jets

By George L. Christian

New York—An old bellows-type shaft seal, which has been giving faithful service for the past six years on Curtis Wright Turbo Compound reciprocating engines, is expanding its applications as turboprop and turboshaft gas-turbine and high speed turbine accessories.

The seal, made by Feltex Seals Division, Robertson Fulton Controls Co., is particularly adaptable to high speed, high temperature steel turbine pressure differentials are moderate. Its proven design and size, the seal can handle shaft speeds up to 40,000 rpm, temperatures of 1,000°F and pressure differentials up to 150 psi.

Feature of the seal is that it will assure leakage-free even under static engine conditions.

Initial design of the seal was incorporated on the turbine shaft of turbo-superchargers used on Boeing B-29 during World War II. A later version was developed through a cooperative effort of Curtis Wright and Feltex Seals as a shaft seal for the turbo power motor turbines on C.W.'s R3150 Turbo Compound engines.

The Feltex Seals bellows seals, which in this case are made of beryllium copper, have been used in both military and commercial versions all the way from sea to space—1946 for the earliest and 1951 for the commercial engine. In power seal plants is the Lockheed P2V patrol bomber, F4U fighter, C-119 Flying Boxcar, Lockheed Super Constellation, and Douglas DC-7 and DC-7C.

Curtis Wright spokesmen told Aviation Week that the seal is an excellent unit and holds up very well. It has an average service life of 2,000 hours while many seals go to 3,000 hours.

Into Jets and Accessories

Feltex Seals, happy with the performance of its seal in the Turbo Compound, is expanding the seal's application to jet engines and high speed turbine accessories.

A company engineer told Aviation Week that a 7-in. diameter, stainless steel (for heat treatment) version of the seal has passed 10,000 tests on C.W.'s 15,000 h.p. thrust J67 turbojet and its T49 turboprop jet turbine engines. One of the seals is installed in front of the J67's front main bearing and a second behind its rear main bearing as main shaft seals. The T49 uses three bellows seals, the same two in the J67



ARROW points to bellows bellows seal installed in a commercial version of the C.W. R3150 Turbo Compound engine.

plus a 3-in. diameter seal on the main accessory drive shaft.

The main shaft seals on these engines rotate at about 7,800 rpm, will withstand temperatures of 600°F and will handle differential pressures of about 16 psi.

F-5 spokesmen said that Pratt & Whitney Aircraft has asked their company to submit proposals for similar shaft seals for an engine on the P4W 15,000 h.p. thrust J75 turbojet powerplant.

In the accessory field, F-5 has submitted a seal design for an air turbine driven fuel pump made by the Union Division of Bendix Aviation Corporation.

The seal, which runs at 40,000 rpm, is for General's B-58 Hustler supersonic bomber.

In similar accessory applications, as F-5 bellows seal has been used as standard equipment for the past five years on an Elgipac Pacacor device as pump.

This seal, also made of beryllium copper, is installed on a 3-in. o.d. shaft and operates at 5,000 rpm at 100 F, with a pressure differential of 15 psi.

On the C.W. Turbo Compound engine, the seal is located on the power accessory turbine shaft at the base of the turbine where it separates the hot

exhaust gases from the oil-cooled turbine shaft.

In this installation, the seal is mounted on a 1 1/2-in. o.d. shaft, rotates at 23,000 rpm at 450 F, with a 15 psi differential pressure.

Beryllium Bellows

A F-5 engineer said that these three qualities make beryllium copper seal for use in bellows material:

- Resistance to permanent spring characteristics over such temperature extremes as -100°F to +450°F. Its ability to retain spring characteristics at -100°F make it desirable to use with liquid nitrogen-cooled machines, while its resistance to +450°F temperatures allow it to be used in cases high temperature applications.

- Resistance to fatigue failure under severe conditions of vibration gives it long life when used on such vibrating machinery as reciprocating engines.

- Resistance to corrosion makes the metal suitable in a wide range of applications where corrosion exists, such as in the vicinity of exhaust gases.
- These three attributes make beryllium copper the ideal material for the bellows seals used on the Turbo Compound where hot, vibration and corrosion are all present in the vicinity of the seal.

The engineer added that Feltex Seals

P&H Welding Positioners give you GREATER CAPACITY and GREATER VALUE for every dollar you invest

3000-LB. MODELS/LOAD-CAPACITY COMPARISON CHART

Chart is shown below at 10' 0" center of rotation and distance at center of gravity of load from base

Distance Positioner	12"	18"	24"	30"	36"	42"	48"	54"	60"
P&H	3000	2500	2000	1600	1200	1000	1250	1250	1100
A	3000	2000	1600	1200	1000	—	—	—	—
B	3000	2250	1800	1500	—	—	—	—	—
C	2385	2167	1728	1424	1212	1038	930	830	750

This chart shows how a typical 3000 lb. P&H welding positioner handles loads far beyond the positions where competitive makes stop. P&H positioners handle big, bulky or odd-shaped workloads with ease because of their three features.

More table tilt — 195 degrees

More clearance for rotation — no legs or posts interfere

Higher table elevations — even under capacity loads

Capacities range from 500 to 30,000 lbs. Send for Load Capacity Data Sheet No. 27 to help you select the positioner best suited to your needs. Write Bill Stephens, Sales Manager, Welding Division, Harnischfeger Corp., Milwaukee 45, Wis.

HARNISCHFEGER

Welding Positioners, Rotators, Turntables
P&H Division, Harnischfeger Corp., Milwaukee 45, Wis.



POWER TURBINE bellows seal used on the C-W R1750 turbo engine. Seal has a 1 1/2 in. o.d., 1 1/2 in. i.d., and a 1 1/2 in. high.

plian is one of the few companies capable of successfully drawing bellows copper into the long (up to 4 ft.), straight, large diameter (up to 3 1/2 in.) tubes required by seals. bellows. The result, he said, is tight control of the metal's grain structure.

F.S. produces the tubes by one step-up operation followed by several successive drawing steps. The tubes are then formed into bellows by simultaneous application of hydraulic and ram pressures.

Bellows Seal

Another company which makes bellows copper products is Fluorac Corporation, Norwood, Ill.

The firm has developed bellows copper bellows up to 3 in. o.d. for unspecified applications.

A Fluorac official said that his company had already been asked by CW to quote on the bellows seal suitable for the power recovery turbines currently being supplied by Fairbanks-Sulphur.

The question is now being considered by Fluorac engineers, he said.

An engineer by AVIATION WEEK of Clifford Manufacturing Company, Wall Lake, Minn., specializes bellows custom, produced the reply that data on current development of high speed, high temperature bellows seals are not available for publication.

Steel Seals

When the seal's operating temperatures exceed the limits of bellows copper—about 1500°-2500° Fahrenheit—the bellows are of steel temperature resistant metals such as stainless steel, Inconel X, and Monel. Work such as much 1 000° Fahrenheit can be produced, but they will have less fatigue resistance than those made from bellows copper, according to the manufacturer.

The company is also working towards making bellows seals out of two other metals.

- **Nylog**—to achieve seals with a very low coefficient of expansion;
- **Titanium**—to produce seals with great strength-to-weight ratios plus corrosion and heat resistance.

F.S. considers that its bellows seals are not competitive price-wise, with steel and mechanical seals, thus, cost three to five times more. But F.S. does not believe that a price comparison is fair because, it says, the bellows seal will do so many jobs as other mechanical seals can do.

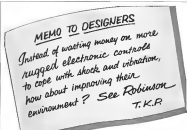
Nor is F.S.'s bellows seal stock, off the shelf item.

Each is tailored especially to a specific job.

WHAT'S NEW

Telling the Market

Specification data and description of fixed-mounted self-latching shock absorbers, Kelsch, Division of The Kmart Co., Box 1081, Terminal Avenue, Los Angeles 54, Calif. Description of standard applications and research, Catalog 18, 9555, Servo Corporation of America, 20 30 Jervis Terrace, New Hyde Park, N. Y. Description and engineering data on the full line of Star Camshaft, catalog, Star Products



HERE IS THE NEW TREND

in the protection of electronic controls for jet aircraft, guided missiles, and rockets by improving their shock and vibration environment.



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WEST COAST ENGINEERING OFFICE 3034 WHITTIER BLVD., SANTA MONICA, CALIF.



Model of Canada CL-35

New Alcoa Alloy

strengthens undercarriage
of Canada's biggest plane

The Canadian CL-35 maritime reconnaissance aircraft will soon go into service with the Royal Canadian Air Force. Developed from the Bristol Britannia else by Canadian, this is the largest aircraft ever to be manufactured in Canada. To strengthen the undercarriage, Canadair selected a new Alcoa alloy, X7079, which meets the Canadian ductility requirement of 4% minimum short transverse elongation.

At the same time X7079 provides a bonus in design allowances which will be especially valuable if Canadair ever wishes to increase the weight of the aircraft. The CL-35 has 42 forgings of X7079, many of them made on Alcoa's 18,000-ton press.

The new alloy has higher yield and tensile strengths than its predecessors, particularly in sections over 3" thick. It is also less quench sensitive which means more uniform properties in heavy sections. As a result, Alcoa® has established guaranteed properties in the end and head forgings up to 6" thick in the T6 temper.

In general, X7079 behaves even better than Alcoa alloy 7075. It has more uniform machinability and has the same excellent resistance to stress corrosion cracking.

This important new development is another Alcoa contribution to aviation progress. For complete technical information on this and other Alcoa aircraft alloys, write: Aluminum Company of America, 3800-A Alcoa Building, Pittsburgh 19, Pennsylvania.

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Co., 14 Mainland Ave., Tuckers N. J.

Illustrations, descriptions and specific data on WPMCO Wire Fasteners and Carbons, Easchman, Bulletin F-33, Wire and Iron Products, Inc., 1723 Seacoast St., Detroit 16, Mich. Basic Switches for Airplane Equipment complete with photographs, dimensional drawings, electrical data and operating characteristics, Catalog 75, Maco Switch, Division of Minneapolis-Honeywell Regulator Co., Fairport, Ill.

Catalog on low temperature apparatus and equipment including cross section and exploded views, capacity and performance charts, and data sheets, Helium Laboratories, Inc., 223 Tenth St. Newark 5, N. J. Complete information on Bennett Basic Models for designing, classified, confidential and secret papers just in being, Bulletin, Bennett Manufacturing Co., Allen, N. Y.

Two technical bulletins describing available ready-to-use material and magnetic field probe capabilities including design details and application data, Dept. 168, Beckman Division Beckman Instruments Inc., 2200 Wright Ave., Richmond 3, Calif. . . . Discharge drawings, photographs, specifications and prices of Varac® adjustable autotransformers, Bulletin 6, General Radio Co., 275 Massachusetts Ave., Cambridge 9, Mass.

Photographs, price, specifications and details of precision RF Probe, Narda Model 229, data sheet Narda Corp. 360 Hercules Rd., Menlo Park, L. I., N. Y. Data on resistance, capacitance, inductance, frequency, etc., and charts and graphs of Basic Carbon Penetrometers, Bulletin 8-66 International Research Co., 401 North Broad St. Philadelphia 8, Pa.

Engineering data for fluid tank installation and illustrations of Easy-On rings and filler necks, booklet, Litan Manufacturing Company, Stuyvesant, New York, 1757 St. Clair Ave., Dept. H, Cleveland 10, Ohio. Illustrations, stock sizes, dimensions, etc. of standard AN fasteners, catalog, All metal Screw Products Company, Inc. 321 Stewart Ave., Garden City, L. I., N. Y.

Descriptions, application information, specifications and engineering drawings of magnetic cooking switches, catalog sheet, Locom North, Co. 174 East 114 St., Cleveland 1, Ohio. Illustrations and descriptions of nondestructive testing and measurement instruments, Bulletin No. 114, General Scientific Equipment Co., 7516 Lorain Rd., Philadelphia 28, Pa.

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**Twin Coach helps Boeing
get them in the air**

Sooner

The Boeing KC-135 jet tanker-transport is of vital importance to the national defense. The prototype of this airplane—America's first jet transport—is shown above. To produce and deliver KC-135s to the Air Force as rapidly as possible, Boeing utilized the aid of Twin Coach Aircraft Division as a subcontractor for major sub-assembly assemblies.

This important assignment typifies the way prime contractors rely on Twin Coach Aircraft Division. For Twin is staffed with experienced aircraft specialists in design and build testing . . . with experienced aircraft production personnel . . . and experienced aircraft supervisors and managers.

If you have an assembly you're thinking of subcontracting, call Twin Coach Aircraft Division. You'll be aware in the knowledge that your assembly will be built by aircraft specialists—by men whose sole aim is to build to specification . . . on schedule . . . at the lowest possible cost.

AS-100



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mill, only one of
its kind in the
country, was
recently installed at
Twin Coach Air-
craft Division.



Publications Received

ASAC's Swales Steel Institution Bibliography—Prepared by the Engineering Research Department of the American Steel Co. and available free of charge from Technical Editor, American Steel Co., 16-67 Rector Street, Flushing, N.Y. 11355.

The bibliography gives the titles and publication addresses of articles published since 1970 on fabrication, assembly, welding, brazing, testing, design, engineering, and various other aspects of stainless steel heat-treating technology.

Index of Technical Publications—Published by the National Aeronautics Association for Aeronautics, 1532 H Street, N.W., Washington 25, D.C. 222pp.

This volume is the fifth supplement to the June 1919-1949 Index and covers NACA research reports issued from June 1913 through June 1950 including those published previously but discontinued within the period.

English Teaching Aids for a Stronger America—Prepared for the Thomas Corcoran Program—American Education Project by Virginia Case—Published by the Materials of Instruction Committee of the National American Education Council and available from Dr. Evan Evans, Executive Director National American Education Council, 1025 Connecticut Ave., N.W., Washington 6, D.C. \$75, 96pp.

One of a series, which includes Mathematics Teaching Aids and Science Teaching Aids, this booklet offers secondary school teachers a program of study based on the world of flight and designed to correct the English teaching program.

Turbopump Fundamentals—by Howard E. Morgan—Published by Douglas Aircraft Co., Inc., Santa Monica, Calif. \$7.95. Purpose of this book is to acquaint flightline personnel with the theoretical theory, operating principle and basic terminology of various aspects of the turbojet engine.

Introduction to Helicopter Aerodynamics—by W. Z. Supercak—Published by and available from, Reinhold Publishing Corporation, Box 55, Madison, Pa. \$4.50.

Revised from the original volume published in 1950, this edition is divided into three main sections: Fundamentals of Rotary Wing Aerodynamics and Practical Methods of Helicopter Performance Predictions prepared by Supercak and Typical Helicopter Performance Calculations prepared by R. J. Harris, L. H. Sims, and K. W. Ulrich, all of Vertol Aircraft Corporation.

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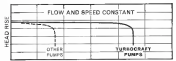
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METEOR AIR TRANSPORT test pilot checks Chance Vought F7U-32 Caduce being used to flight test a client's equipment destined for USAF.

Meteor Uses Outlass to Evaluate Products Destined for Air Force

New York—Acquisition of a built high speed jet enables the Equipment Flight Test Division of Meteor Air Transport to serve the most advanced phase of its outclass business service: that of providing military equipment manufacturers with realistic outclass product evaluation facilities. The new phase of its operations involves flying a Navy jet to test equipment destined for USAF use.

Some two years ago EFTD began providing methods for fast-paced manufacturing according to flight test results on their own equipment prior to starting production (AW Aug. 1, 1955, p. 33). It started by using outclass modified C-46 cargo type aircraft of the parent owned aircraft now based at Veterans (NY) Air port.

Switch to Jet

As a result of one of these flight test programs, the division graduated into flying a jet. Its client at the particular time is Servo Corporation of America, Nos. Hyde Park, New York, a prime contractor for military infrared weapon systems and infrared control systems and components for military.

EFTD began working with Servo about a year ago, flying some 15 known as C-46, a highly specialized piece of equipment it was developing for the U. S. Air Force. The type of equipment as yet cannot be identified as described. The initial flight test pro-

gram as the C-46 involved a "bread board" model of the gear. EFTD later was given an additional contract to take an improved version of the equipment aloft for 25 hr.

The Air Force speed that EFTD handles the entire 50 hr flight program.

Jet Needed

The Meteor division put the equipment in a C-46 and gave it 25 hr of flight test for the duration of the program.

But the second phase called for the test 25 hr to be conducted under realistic conditions and speed approximating intended service use and this could only be accomplished in a jet.

The first break was that the Air Force had no suitable gear available to meet the prime contractor's schedule. So far as EFTD manager Jim Kinsard knew there was no previous case of an independent flight test facility obtaining or operating military jet aircraft by a prime contractor. A major problem was that although the equipment was intended for USAF, that service had no airplane to spare.

Approached Navy

On a long shot Kinsard approached the Navy.

He learned that the Navy was planning to mobilize the Chance Vought F7U-32, photo-reconnaissance version of the Caduce airplane that met the

specifications for the required high-speed form.

On a request originating from the office of the Chief of Naval Operations, Baker visited with Wright Air Development Center on releasing an F7U-32 at Norfolk, with WADC approving the flight test contract.

Contract Terms

Under the terms of the contract, Meteor's Equipment Flight Test Division has to maintain the airplane with parts support from Chance NAS, R. I. and fuel supplies being handled by Chesapeake AFB. EFTD also has to provide insurance coverage for property damage, public liability and general comprehensive compensation for all personnel working on the project. Chance personnel also assisted the equipment and efficient recording devices.

They found that contribution of the equipment resulted in a shift in the airplane's center of gravity which they compensated for by using aluminum blocks to lighten the shift under the vertical tail.

The airplane was delivered from Norfolk NAS, Va., to Floyd Bennett NAS, Jamaica, N. Y., by Kinsard and the flight test program will be conducted from the latter station. EFTD pilot Edward Bochebauer's program calls for operations under visual flight rules, day and night, making 500 ft passes over the selected targets at speeds of more than Mach .9.

EFTD will not reveal the dollar volume of the test contract, but it runs into five figures.

The initial flight test facility did cost \$750,000 south of Washington in the first three-quarters of 1950, Kinsard told Aviation Week. In its first year it did approximately \$350,000.

In another two years he feels confident that it could reach \$2 million annually.

Upcoming Programs

The division manager is now trying to buy a C-46 from the Air Force to handle two upcoming test programs involving under equipment. The programs involve extensive cutting into the airplane's belly to install the gear and the Air Force airplane already has the modifications. Should EFTD have to use one of its C-46s, Kinsard estimates that the test costs would cost the Air Force \$60,000 more than if he bought or leased their airplane, in addition to the time saved in cutting an airplane apart.



TEARLAND Ag-2 prototype lies down charcoal for student piloting for fire in order to establish fire tests.

Prototype Ag Plane Tested During Fire

Torrance, Calif.—Tearland Ag-2 airplane and its prototype, under test at its capabilities during fire at over distances 40,000-50,000 ft. The plane is the Malibu, Santa and Lake Sherwood areas of Southern California.

Tearland Co., Torrance Municipal Airport, temporarily pulled the airplane out of a flight test program for Civil Aeronautics Administration Part III certification to meet with the Los Angeles County Fire Department's demand that it fighting the rapidly spreading fire.

According to the company, the Ag-2 was the only airplane which participated in this project, along with a helicopter leased by the Sheriff's Department for observation, liaison and ground support, such as hour flights. Los Angeles County Fire Department has been studying the aerial operations in cooperation with Dr. Keith Arnold, Division of Fire Research, California Forest and Experimental Station, University of California, Berkeley.

Evidence Inconclusive

County fire officials are "highly interested" in the use of the Ag-2 for fire and forestry duties, according to the manufacturer, although the company says that the department feels that the evidence accumulated is inconclusive and does not establish the effectiveness of the test.

Prior experience with large numbers of airplanes on previous smaller blazes has shown that aerial fire fighting is an effective technique (AW Jan. 7, p. 54). Tearland states that it received a phone call from a teacher complaining the effectiveness of the Ag-2 in preventing the fire from spreading for much in Malibu Canyon. Dr. Arnold contacted that the Ag-2 showed its capability for



AG-2 SPREADS fire line with charcoal mix supplied by Los Angeles County Fire Dept.



CHEMICAL FIRE RETARDANT is used as truck fuel to replace at Santa Monica Airport.



UP NEW ENGLAND WAY OR DEEP IN DIXIE *Esso is there... at 600 airports from Maine to Texas! Now, through a real pleasure - when you stop at any Esso Aviation Dealer's. (And there's bound to be one just about anywhere you go!) They'll relieve you of irritating worries and keep you on schedule. If you have an Esso Credit Card, it's even better. Because then you can charge not only gasoline, oil and lubrication, but tire and battery service, landing fees, overnight inventory storage and most other emergency repairs. Make a note: next trip get poor service from an Esso Aviation Dealer.*



entering large loads into the fire area and that its maneuverability permitted operation close to it. Jettison began Ag 2 pilot Robert (Butt) Masterson, co-pilot captain and graduate of USAF's Experimental Flight Test School, Edwards AFB, reported that the airplane operated with ample power reserve to provide for a wide range of maneuvering, and fuel weight stability was excellent.

He noted that his principal hazard was close proximity of "lightning" activity and close proximity to USAF jet fighters.

Chemical Drops

Avoid also commented that the chemical drops could have been more effective if the airplane was fitted with a larger drop pipe. Translated, although the drop system works, but the emergency conditions did not give it enough time to provide the necessary modifications and that the drops were made using wing tanks and their respective drop valves designed for normal agricultural spray application. To counter these adverse effectiveness, pilot Masterson flew at lower altitudes - in, to 10 ft - instead of the 10-15 ft recommended by the manufacturer. The Sea Breeze and Sea Dragon fires due to neglect began in some areas that low flying technique was not practical.

The experimental program covered four days. During the first day, the Ag 2 made two test drops with water only, since the fire-retardant foam chemicals and mixing equipment were not available.

The Los Angeles County Fire Department furnished chemicals, mixing equipment and crew from the second day onward.

31 Drops

Stationed at Santa Monica Municipal Airport the Ag 2 made 31 drops totaling more than 54 tons of water-borne mix.

Some 163 gallons of the mix were pumped into the plane's four wing tanks for a total payload of about 2,500 lb.

Most of the drops were made into canopies covering areas in the path of the fire flying downhill into the canyons at about 50-60 mph, using 70-deg flap at height of 50 to 70 ft. Southwicks were 15-40 ft wide and about one-half mile in length. Flight length from the airport to the fire, including maneuvering and return, averaged 50 mi.

Drop time was 20-30 sec with drop speed averaging 110 mph.

During the first drop of the day, the Ag 2 shed 400 gal of fuel and three gallons of oil.

Fairchild Completes Big Peruvian Survey

Lexus Peru—Using two aircraft, hand-held Aerial Services, Inc., has completed a photographic and magnetometer survey covering virtually all of Eastern Peru in cooperation with the National Aerial Photographic Service of the Peruvian Air Force.

The Twin Beech and the Lockheed Lodestar flew 20,000 mi in the course of the aerial survey, including some 15 million feet of film exposures. A better quality approximately 2.5 acres Fairchild handled the photo and magnetometer work. The Peruvian photographic resources.

The photographic work was handled at altitudes averaging 20,000 ft above the terrain. The magnetometer survey was flown at about 1,500 ft altitude. The project took nearly two years to complete.

Surveys covered nearly all of the Ucaich and Manabio River valleys and tributaries, except for the Santiago River flowing into the Amazon from the north. Low cloud cover previously baffled the usual survey efforts in the latter area.

Among the projects currently participating in the work is the Model 100 Company of Peru, Peruana Oils &

GOING UP!

Higher speeds and better altitudes mean higher temperatures and greater mechanical problems. These problems are all to do with work at the 100 ft. Flying 100 ft. Co. where every one of our careful engineers is here to provide you with the very best products regularly in the production of special mechanical components for an exact design, not just. Most have been tested and verified.

The same successful experience has also developed Foster's unique hand-screw details. "SQUARE" is now available in production quantities for applications demanding heat resistant properties with high strength.

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The amplifier is a sealed unit and will withstand a differential pressure of 15 psi. Either channel may be repaired or replaced without affecting the second channel.



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SeaBee Conversion Undergoes CAA Tests

Detroit, Mich.—Flight test program on a modified version of the former Republic SeaBee private amphibian developed by Santos Skyways Service, Detroit City Airport, has gone well over the 100 hr mark. The modifications, being developed in fit down for current SeaBee owners, is aimed at increasing the airplane's takeoff and climb performance.

Costs cost of the late and detailed performance data results completion of the tests for Civil Aeronautics Administration approval, according to George Santos, President, data shows that the new Super SeaBee is the model has been retained in Series will have a 4,100 ft/min climb at full gross weight will maintain 13,000 ft altitude on 60% power and take one-third less time to leave the ground or water than did the original airplane. Performance gains are primarily attributed to modifications to the standard 205 hp Franklin engine, which now develops 280 hp fitted with a three-blade reversible pitch propeller.

Other changes include speed-brake-inlet leading gear, improving cruise speed some 10 mph, according to Santos, an automatic hydraulic system for flap and landing gear, revised propeller and thrusting control arrangement replacing a two-axial system and Fiberglas wingtips.

Cessna Civil Sales Reach \$50 Million

Wichita—Business and utility aircraft sales by Cessna Aircraft Co.'s, dealer organization approached \$50 million in calendar 1966, an increase of more than \$10.5 million over the previous year and more than \$15 million higher in retail dollar volume than its nearest competitor. Beech Aircraft Corp. Beech retail dollar volume in calendar 1966 was \$33,846,575, Piper was \$22,488,027 and Aero Design & Engineering Corp.'s was \$14,702,546.

Last year Cessna delivered 3,235 aircraft to its dealers, more than the total of the other three leading business plane manufacturers combined and a considerable gain over its 1955 deliveries of 1,746 units. Combined sales of Cessna, Beech, Piper and Aero Design & Engineering Corp. totaled more than \$128

million in retail dollar volume and 6,485 units.

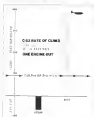
The increase represented the largest in Cessna's history. Break-down in models, in calendar 1956-72 Model 170s, 140R Model 172s, 310 Model 180s, 441 Model 180s, 310 Model 310s and av. Model 190s, the latter being out of production compare against an out released to private customers.

Sales of the light twin Model 310 accounted for 51% million in retail sales volume last year. More than 450 of these airplanes have been delivered since this type went into production in late 1954.

PRIVATE LINES

Forecast that Bell Helicopter Corp. will do an annual commercial helicopter business of \$50 million by 1970 was made in Henry Gordon, president of the recently formed corporation, formerly a subsidiary of Bell Aircraft Corp. The helicopter manufacturer's commercial business in 1966 approached \$4.5 million of a total of \$55 million in sales that year.

Improved Fairchild C-82 perform some demand for modifications developed by Howard Davis, Inc., Gordon said, are shown in accompanying graph. Aerial in improving the C-82's engine-out climb, major highlight of



the new kit in installation of a pair of Westinghouse J30 turboprop auxiliary powerplants atop the fuselage. The first phase a flight demonstration of a fully modified C-82 to interested prospects February 28 at Los Angeles is scheduled April.

Related, helicopter operating manual now of American, Coleman National Airways, now has new rotary wing aircraft working with petroleum experts

two horse- power

... yet only
3" x 6 1/2"



FIGURE 100

Here is the most powerful electric motor for its size and weight made today. Weighing only 6½ oz., this is an American motor conforming to modified military specifications and is available in a wide variety of configurations to meet your needs. The unit is totally enclosed and explosion proof. It is offered in single or three-phase, 400 cycle, 115/220 V., and performs with full efficiency under high temperature and shock conditions. Available with brake or clutch, fan or blower, standard or special shaft and gear accessories or straight drive.

1.125 B.P. Sub-Minature MVI, Figure 100
This unit, only 3" x 6 1/2" and weighing 6½ oz., is widely used as a component in electronic systems or timing devices. It is totally enclosed and meets military specifications. The motor is available with a variety of gear buses and accessories; either induction or synchronous, 1 or 3 phase, 400 cycle, 115 V.

Shown here are only two of the wide range of motors produced by American. Special types can be engineered for your particular needs. Write for technical information.



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A little pull in the right place...

Alcraft's Wire's Wire Reports

A cross section of the Wire's Wire in the aircraft industry—including Douglas, Allison, Fairchild, Grumman, Martin, Republic, General Ltd., Pratt and Whitney among a host of others—is reported to have reduced engine wiring time as much as 80%. This saving is effected by the use of the new Robinson Wire Twister, an improved model of the ones that have gone on service with the army, navy and service since 1943. Improvements include the exclusive diagonal jaw design that permits easier access to hard-to-reach areas, and slings a wire like a grip on the arm by pulling it into a 90° bend thus delivering added leverage for twisting.

In addition to the greatly increased engine wiring speed, users attest to improved shop safety—fewer skinned knuckles and burned fingers.

Besides their production line assignments, Robinson Wire Twisters readily adapt in the shop to bench work on radio and radar equipment, on magnets, capacitors, antennas and sub-assembly work of all kinds.

List price is \$38.50. Write for fully descriptive literature to Ralph C. Robinson Company, Dept. W, Box 5484, 2516 Conkey Way, North Sacramento 15, California.



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3. New tensioning mechanism provides positive locking and cable-releasing action.
4. White red is locked either by means of manually with harness cable extended the harness cable will retract into the reel when load is removed from cable.
5. Angle of emergency with respect to longitudinal axis of aircraft, is not critical.
6. Thinner red-top overall. May not contain and control cable only as a check.
7. Manual control requires no adjustment at time of installation. Positive push-pull control cable provides instant, manual operation when used on adjustable seat.
8. This new retracting cable spooling is on her neck of one automatic reel.
9. Easily removed. Manual control control cable is not cut but is replaced without disassembling other components. Manual cable is not cut but is replaced easily by service personnel.
10. Simple assembly for post development work.

Model 21 Inertia Reel

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low companies in that country. The subsidiary was organized last year with three B-17D1 helicopters. During one month's operation with Shell Oil Co. in Magdalena, the three B-17s made 5,000 flights carrying 640,517 lb. of freight and personnel.

Enlarged exhibit area is planned for Renshaw Aviation Service's 8th annual business aircraft maintenance and operations meeting, June 1 (one date June 2) Renshaw, 7741 Massachusetts Avenue, Philadelphia. Rates will range from \$250 for a 10 ft sq area to \$675 for a 10 ft x 10 ft space.

Delton Automotive, Inc., Inc. last fiscal year had 4,100 aircraft engines in 1955, an increase of 50% over 1954. The firm had a payroll of about \$2.1 million last year.

Aerobics magnetometer survey to locate iron ore is being done in North western Illinois by Aero Service Corp. Philadelphia, Pa., for Liberton Mining Co., Ltd. Costing about \$500,000 the surveys are using a modified General PBY amphibious biplane with Galk wing instruments in a tail "stranger" modification. Shown gear in the aircraft and in two ground stations will be used for accurate flight positioning.

Cooder magnetometer is a modified version of Coover's Super Geom being developed by Data 11 Truckee Enterprises, Inc. Mount Geom will feature an electronically mounted slotted type wing flap, increased shockproof resistance and magnetic control system for the elevation, one half inch wing electric booster pumps for the auxiliary tanks. The G-meter is expected to have a move speed of 168 mph and landing speed of 90 mph at 8,000 lb gross weight.

Agricultural pilot course at South Dakota State College has been short-circuited from 10 to four weeks. Course will now be held from April 1 to April 27.

Prototype Minuteman-10A is present jet nation wing aircraft at aircraft, undergoing test-drops at Seattle, Wash. Model 10A will have a Lycoming VOR-10 engine driving a conventional compressor and compressed air pump, up the rotor shaft out through the blade tips.

Whirlwind trainer is all-rolled from broad construction especially designed for transporting Bell Model-47 helicopters. Unit has a landing wheel four-wheel brakes. Hawk, Dickinson, P. O. Box 7149, Spokane Street, T1, Wash., 7749, is marketing the trainer at \$1.375.

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Avionic Consumers Union Proposed

By Philip J. Khan

Washington—Plans are under way to set up an industrywide component testing service which could save the aviation industry millions of dollars and ease equipment makers' cash loads by duplicating the efforts of the others.

The program proposed by Inland Testing Laboratories is intended to coordinate the efforts of such companies as Cook Electronics Co., which has facilities available to the war in which Consumers Union operates in the consumer products field, with subcontractors during the cost of mass component qualification tests and the resulting data.

The idea was received with interest and enthusiasm by representatives of more than a dozen companies who were quickly involved in it. Inland, during the recent National Symposium on Reliability & Quality Control in Electronics.

Test Results

Under Inland's plan each participating manufacturer would receive periodic data on the results of the component qualification test program in the form of a Handbook of Electronic Parts Reliability, edited by H. E. L. P. K. for short. This data, for example, would include a summary of extreme component failure rates during design, establish component derating curves, conduct accelerated reliability tests to establish acceptable criteria for screening inspection of components and in production. H. E. L. P. K. is intended to relieve the manufacturer's test efforts, Inland's General Manager George Brown explains.

Inland would test components in those environmental conditions most readily acquired by the majority of its clients. Any company that needs components for an unusual environment



INLAND TESTING LABORATORIES, already heavily engaged in component qualification testing for individual customers, proposes to set up "Consumers Union" type service which would duplicate much of the duplicate effort by individual member companies.

would have to run each qualification test itself.

The electronics industry, today is spending \$20-25 million annually on component qualification testing according to a recent survey conducted by the Radio Electronics Information Manufacturers Association. Some observers believe the industry total is closer to \$30 million annually.

Hughes Aircraft Co., for example, spends more than \$2 million annually on component qualification testing, not that most manufacturers about half of its work. North American's Automotive Division has 20 engineers and technicians centrally engaged.

The R. E. M. A. survey indicates that the industry wide average is 15 engineers and technicians per company. Leslie Wampler of Eclipse Process told that company.

But despite these individual programs, R. E. M. A.'s survey reveals that 90% of the companies feel a need for additional information beyond what is generated by their own programs.

Behind the Need

The primary reason has developed design procedures set up by the military services some years ago which were intended to eliminate incentives in component selection.

Military specifications prepared for each of the basic types of electronic components are intended to assure the availability of components suitable for the environment in which military equipment must operate. The concept was that component makers would submit samples of their products to the military for qualification testing by the appropriate MIL specification. If the samples passed the manufacturer's component would be listed on the "Qualified Products List."

In theory, to assure the adequacy of components for military use, equipment, an aviation equipment manufacturer need only select from products listed in the QPL. Unfortunately, this has not panned out as practice for a number of reasons.

•Security of environmental conditions encountered in highspeed aircraft and missiles has increased so rapidly that most MIL specification requirements are no longer adequate—particularly for the



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The Price of Duplication

The cost of component qualification testing conducted by all major electronic electronic equipment manufacturers has been revealed by a recent Radio Electronics Information Manufacturers Association survey which indicates that half of those companies now spend \$50-100 in more annually on each program. 4% of those surveyed spend more than \$100,000 and 1% spend over \$500,000. R. E. M. A.'s survey reveals

With military demands for rapid component reliability to meet the needs of new jet-powered systems, civilian manufacturers will be forced to expand the scope of their qualification testing and use much larger sample sizes. This could double or triple the facilities and manpower now required, with corresponding increases in cost.



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Camouflaged in official NATO colors and proudly flying the Canadian Ensign on their tails, the first Royal Canadian Air Force squadron of AVRO CF-100's to join NATO air defence in Western Europe, departs for its base in France.

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high degree of reliability which the military now demands.

• MIL specifications requirements tend to be a compromise within the technological reach of the majority of component manufacturers. Political considerations inhibit against a specification which only a single component manufacturer can meet, thereby eliminating the often three military markets.

• Initial component qualification test on limited samples, without the requirement for periodic requalification tests, do not provide sufficient guarantee that the component manufacturer is maintaining the same product quality.

• New "unqualified" components whose performance exceeds existing MIL specifications limits are often needed to meet tough environmental requirements and equipment makers cannot wait for revisions on the military qualification test results.

These are some of the reasons that explain why 75% of the RDT&I navy respondents in the military electronics field indicate that they conduct their own qualification tests as non-potential, despite military QPL listings.

Economic Barrier Ahead

Unless an industry-wide approach to qualification testing is found, equipment manufacturers are going to have to wait even more heavily in test facilities and equipment as the new test future, according to Dr. Leslie W. Bell, Bell, former technical director of United Commonwealth Laboratories and now an engineering reliability consultant says. "We are facing a national need to run qualification tests on samples of 1,000 units in mass compared to the samples of less than a dozen now used."

The reason is the costly increased degree of reliability needed for weapons such as the autonomous guided missiles. Where extremely low failure rates are required in very complex systems it either is necessary to test a few samples for thousands of hours which drives the whole program or the use of an extremely large sample.

Furthermore, the more diverse ways in which a component can fail means that a small sample may not be representative of all the different possible modes of failure, according to Bell.

Shave Cost

Dr. Bell believes the only solution is for industry to share in the cost of testing and data collection and then share in its distribution.

Furthermore, Dr. Bell believes that new weapons require to high a degree of reliability that component testing need be shifted toward down-on at the base causes of unreliability in a given component as well as determining

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TI PRODUCTION ENGINEERING helped Lockheed trim 55 lb of dead load from the F2V-7 sub-hunting Neptune... by transmuting just one system—the 14-station intercom. In addition to saving weight, safety and reliability were increased while maintenance and power drain were reduced.

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whether it meets required qualifications tests. This requires "assembly detection" not mere inspection, according to Bell, and he believes the relatively few persons with this kind of skill should be concentrated in a few testing centers.

Island's Proposed Plan

Island Testing Laboratories, which has been conducting environmental test qualification tests for radars and the military systems on an individual contract basis for more than six years, has formulated a tentative plan for the operation of its proposed MILITARY program which it envisions is exploring with a number of major aviation manufacturers.

To provide the kind of service which subcontractors seek, Island proposes to act up a subcontract advisory board, elected by the subcontractors. The advisory board will guide the company's program, determine the quality of components tested, recommend preferred test procedures and data reduction methods.

As now envisioned, Island would first conduct "screening tests" on components selected for test. The purpose of these tests would be to weed out

those with high failure rates and to determine which environmental parameters have the greatest effect on the reliability of those components which pass.

Following the initial screening tests, sample quantities of those that pass will then be subjected to composite test runs designed to simulate their use in ground-based or airborne equipment. These environmental parameters which the screening tests reveal to have the greatest effect on component reliability will be used as variables in production tests which show the relationship between, say, temperature and component life.

From such tests, and subsequent studies, Island expects to be able to furnish its subscribers with the following types of data on each component tested:

- Failure rate.
- Correlation between failure rate and operating environment.
- Change of performance parameters with time.
- Basic cause of failure.

In addition, Island proposes to conduct accelerated tests on components to obtain a correlation between their reliability under abnormally severe con-

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environmental conditions and their reliability under normal stage environmental conditions.

With such data, an aircraft equipment manufacturer will be able to use accelerated tests to determine parts in question for production programs to determine more quickly whether the quality of the lot meets its requirements.

Inland is no exception to qualification testing. The operation was started originally by Cook Electronics Co. for its own tests, then in 1949 was made an independent division to take on environmental testing for outside companies. Since 1949, Inland has been performing QPL testing for the Signal Corps in addition to its contracts with individual companies in the electronics industry.

At present Inland employs about 125 people, about 170 of whom are engineers and scientists, including three Ph.D.s. Last year the company did about \$1.2 million in testing and currently has a backlog of \$1 million for such work. One program, for a major computer modification, involves pain tests on 20,000 diodes, 70,000 resistors and 20,000 capacitors.

To handle the millions of measure events and data involved in such a program of this magnitude, Inland employs automatic recording and data reduction techniques which it believes are standard for the HELFR program at present.

If the HELFR program is launched, Inland expects to more than double its present staff and invest \$14.7 million in test and data reduction facilities.

What It Will Cost

The scope of Inland's HELFR program and the cost of such service to individual subscribers will depend to some degree on the number of companies participating. Thus, in turn, will depend upon the charge for the service.

In sounding out representatives of major aerospace companies, Bendix has found an almost unanimous belief that \$10,000 in a testing figure. However, Inland is touting with the idea of having the charge as each subscriber's total routine derivation business, since the value of the HELFR data is a very high return on investment in its routine sales.

AMTMA Week added representatives of service major aerospace companies whether they believed their firm would be willing to participate on the basis of a \$10,000 annual fee. The response was unanimously in the affirmative. In each case the companies are spending considerably more than the figure for their qualification testing.

In the AMTMA survey, respondents were asked whether they would be

willing to exchange their qualification test data with other companies. Approximately 55% indicated a willingness to exchange, 6% declined, and 41% were undecided.

Legal Question

However, because AMTMA is a trade association, legal questions have been raised as to how it could exchange data without risk of being accused of restraint of trade. The reason is that dissemination of adverse test results on any manufacturer's components might be construed by its given suit.

AMTMA has considered the possi-

bility of limiting its data exchange solely to favorable reports, i.e., data on those components that have successfully passed qualification tests conducted by member companies. However, many observers feel that under restrictions the value of exchanged data would be severely limited.

AMTMA Week's conversations with a number of aerospace companies and other firms prefer the proposed Inland HELFR program.

Companies wishing to obtain more information on HELFR can do so by writing Mr. George Brown, Inland Testing Laboratories, 681 W. Oakton St., Mount Grove, IL.



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Incidents as well as individual manufacturer's sales, financial, employment, production and plant statistics will be given. Included will be

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ELAND design provides a wide range of power in a one-sized package. The 3,000-4,500 e.h.p. range of ELAND engines differ nothing in size and only little in overall weight. This flexibility will enable operators to standardize on one basic engine and nacelle design where two or three different types of piston engines are now required.

Conversion of the Comair 340

The Napier Eland Conquest—a Conquest 340 which we bought from the makers and converted to ELANDs—has proved the simplicity of ELAND installation, the low cost of conversion and the increased profits that accrue from ELAND operation.

From studies made of the published direct operating costs (including depreciation) of a number of typical airlines, it is proved that in the light of our guarantee a converted aircraft will be cheaper to operate—whatever the costs are calculated on the basis of engine fuel, two pilots or passenger miles. The ELAND-engined Conquest 340 can carry its maximum payload 950 miles farther than piston-engined Conquests, and its cruising speed is 40 m.p.h. higher.

It is short no value to operators of the Conquest—and other medium-haul planes—in service with a new lease of life at a cost which will be written off over a relatively short period. That is the essence of the case for ELAND conversion.

Eland conversion means increased profits to the progressive airline

O. SARGE AND SON LIMITED... LEADERS IN THE ELAND...
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Below is a series of air-propeller engines fitted conversion the Conquest 340, the Elan, the Elan, the Elan.

ADVERTISERS IN THIS ISSUE

AVIATION WEEK, JANUARY 26, 1957

A. C. SPER, PLUS INC. GENERAL MOTORS	100
ALCOHOLIC DISTILLERS ASSOCIATION	101
ALCOHOLIC DISTILLERS ASSOCIATION	102
ALCOHOLIC DISTILLERS ASSOCIATION	103
ALCOHOLIC DISTILLERS ASSOCIATION	104
ALCOHOLIC DISTILLERS ASSOCIATION	105
ALCOHOLIC DISTILLERS ASSOCIATION	106
ALCOHOLIC DISTILLERS ASSOCIATION	107
ALCOHOLIC DISTILLERS ASSOCIATION	108
ALCOHOLIC DISTILLERS ASSOCIATION	109
ALCOHOLIC DISTILLERS ASSOCIATION	110
ALCOHOLIC DISTILLERS ASSOCIATION	111
ALCOHOLIC DISTILLERS ASSOCIATION	112
ALCOHOLIC DISTILLERS ASSOCIATION	113
ALCOHOLIC DISTILLERS ASSOCIATION	114
ALCOHOLIC DISTILLERS ASSOCIATION	115
ALCOHOLIC DISTILLERS ASSOCIATION	116
ALCOHOLIC DISTILLERS ASSOCIATION	117
ALCOHOLIC DISTILLERS ASSOCIATION	118
ALCOHOLIC DISTILLERS ASSOCIATION	119
ALCOHOLIC DISTILLERS ASSOCIATION	120
ALCOHOLIC DISTILLERS ASSOCIATION	121
ALCOHOLIC DISTILLERS ASSOCIATION	122
ALCOHOLIC DISTILLERS ASSOCIATION	123
ALCOHOLIC DISTILLERS ASSOCIATION	124
ALCOHOLIC DISTILLERS ASSOCIATION	125
ALCOHOLIC DISTILLERS ASSOCIATION	126
ALCOHOLIC DISTILLERS ASSOCIATION	127
ALCOHOLIC DISTILLERS ASSOCIATION	128
ALCOHOLIC DISTILLERS ASSOCIATION	129
ALCOHOLIC DISTILLERS ASSOCIATION	130
ALCOHOLIC DISTILLERS ASSOCIATION	131
ALCOHOLIC DISTILLERS ASSOCIATION	132
ALCOHOLIC DISTILLERS ASSOCIATION	133
ALCOHOLIC DISTILLERS ASSOCIATION	134
ALCOHOLIC DISTILLERS ASSOCIATION	135
ALCOHOLIC DISTILLERS ASSOCIATION	136
ALCOHOLIC DISTILLERS ASSOCIATION	137
ALCOHOLIC DISTILLERS ASSOCIATION	138
ALCOHOLIC DISTILLERS ASSOCIATION	139
ALCOHOLIC DISTILLERS ASSOCIATION	140
ALCOHOLIC DISTILLERS ASSOCIATION	141
ALCOHOLIC DISTILLERS ASSOCIATION	142
ALCOHOLIC DISTILLERS ASSOCIATION	143
ALCOHOLIC DISTILLERS ASSOCIATION	144
ALCOHOLIC DISTILLERS ASSOCIATION	145
ALCOHOLIC DISTILLERS ASSOCIATION	146
ALCOHOLIC DISTILLERS ASSOCIATION	147
ALCOHOLIC DISTILLERS ASSOCIATION	148
ALCOHOLIC DISTILLERS ASSOCIATION	149
ALCOHOLIC DISTILLERS ASSOCIATION	150
ALCOHOLIC DISTILLERS ASSOCIATION	151
ALCOHOLIC DISTILLERS ASSOCIATION	152
ALCOHOLIC DISTILLERS ASSOCIATION	153
ALCOHOLIC DISTILLERS ASSOCIATION	154
ALCOHOLIC DISTILLERS ASSOCIATION	155
ALCOHOLIC DISTILLERS ASSOCIATION	156
ALCOHOLIC DISTILLERS ASSOCIATION	157
ALCOHOLIC DISTILLERS ASSOCIATION	158
ALCOHOLIC DISTILLERS ASSOCIATION	159
ALCOHOLIC DISTILLERS ASSOCIATION	160
ALCOHOLIC DISTILLERS ASSOCIATION	161
ALCOHOLIC DISTILLERS ASSOCIATION	162
ALCOHOLIC DISTILLERS ASSOCIATION	163
ALCOHOLIC DISTILLERS ASSOCIATION	164
ALCOHOLIC DISTILLERS ASSOCIATION	165
ALCOHOLIC DISTILLERS ASSOCIATION	166
ALCOHOLIC DISTILLERS ASSOCIATION	167
ALCOHOLIC DISTILLERS ASSOCIATION	168
ALCOHOLIC DISTILLERS ASSOCIATION	169
ALCOHOLIC DISTILLERS ASSOCIATION	170
ALCOHOLIC DISTILLERS ASSOCIATION	171
ALCOHOLIC DISTILLERS ASSOCIATION	172
ALCOHOLIC DISTILLERS ASSOCIATION	173
ALCOHOLIC DISTILLERS ASSOCIATION	174
ALCOHOLIC DISTILLERS ASSOCIATION	175
ALCOHOLIC DISTILLERS ASSOCIATION	176
ALCOHOLIC DISTILLERS ASSOCIATION	177
ALCOHOLIC DISTILLERS ASSOCIATION	178
ALCOHOLIC DISTILLERS ASSOCIATION	179
ALCOHOLIC DISTILLERS ASSOCIATION	180
ALCOHOLIC DISTILLERS ASSOCIATION	181
ALCOHOLIC DISTILLERS ASSOCIATION	182
ALCOHOLIC DISTILLERS ASSOCIATION	183
ALCOHOLIC DISTILLERS ASSOCIATION	184
ALCOHOLIC DISTILLERS ASSOCIATION	185
ALCOHOLIC DISTILLERS ASSOCIATION	186
ALCOHOLIC DISTILLERS ASSOCIATION	187
ALCOHOLIC DISTILLERS ASSOCIATION	188
ALCOHOLIC DISTILLERS ASSOCIATION	189
ALCOHOLIC DISTILLERS ASSOCIATION	190
ALCOHOLIC DISTILLERS ASSOCIATION	191
ALCOHOLIC DISTILLERS ASSOCIATION	192
ALCOHOLIC DISTILLERS ASSOCIATION	193
ALCOHOLIC DISTILLERS ASSOCIATION	194
ALCOHOLIC DISTILLERS ASSOCIATION	195
ALCOHOLIC DISTILLERS ASSOCIATION	196
ALCOHOLIC DISTILLERS ASSOCIATION	197
ALCOHOLIC DISTILLERS ASSOCIATION	198
ALCOHOLIC DISTILLERS ASSOCIATION	199
ALCOHOLIC DISTILLERS ASSOCIATION	200

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